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FACTORY

MANAGEMENT and MAINTENANCE

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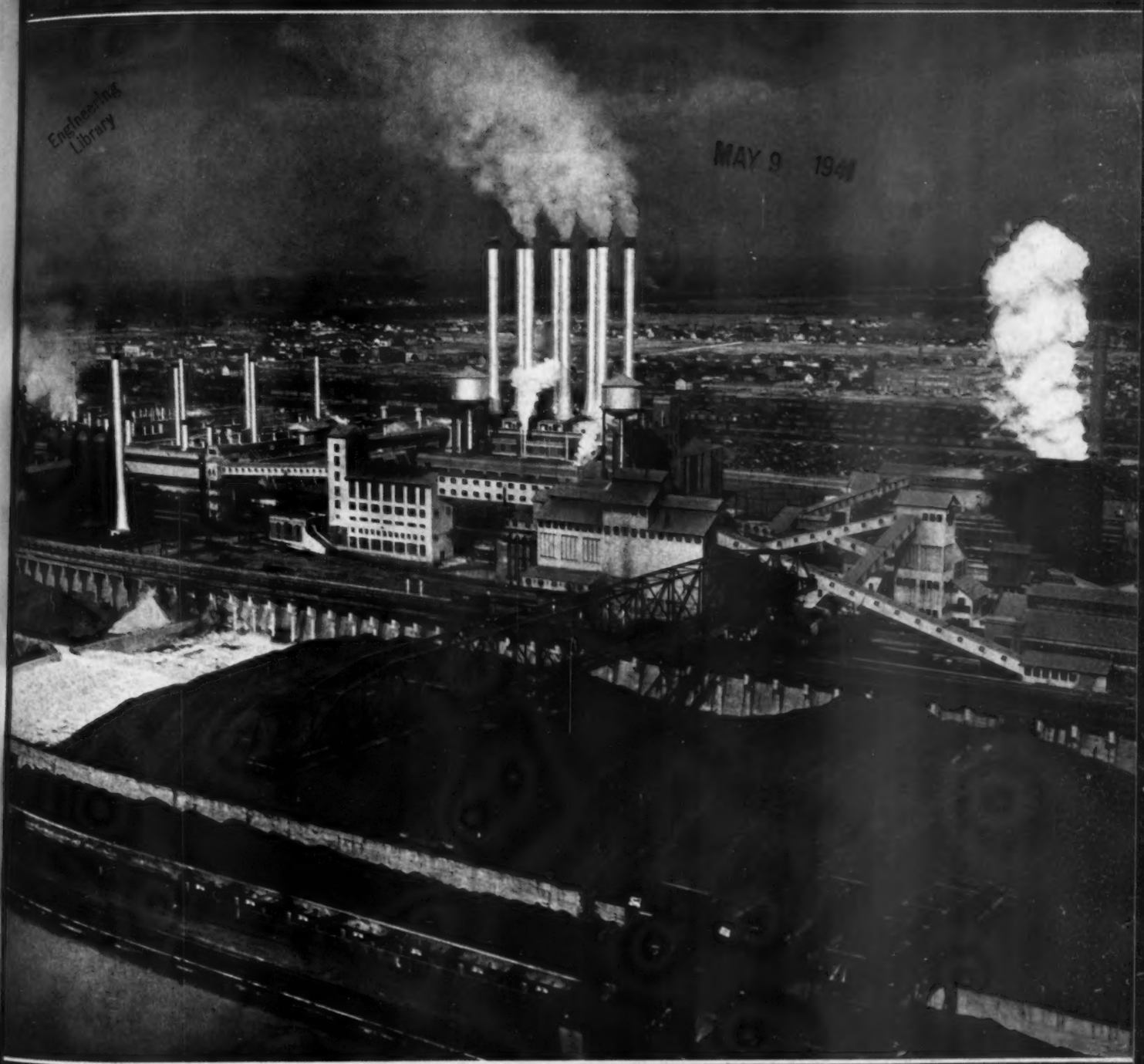

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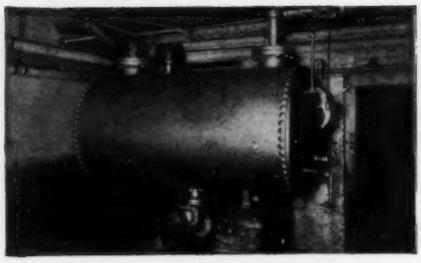
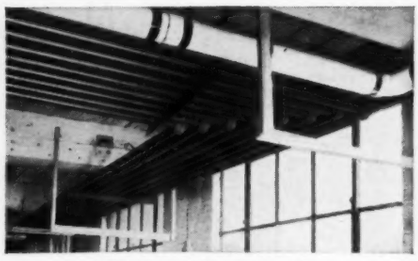


30-year-old boiler feed tank
Eberhard Faber Pencil Company

Coils in sand dryer—Central Silica Co.

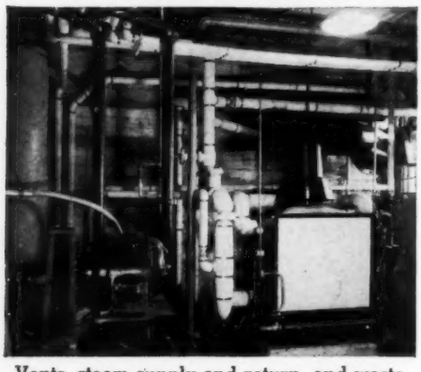
Boiler feed, heating return, hot and cold water lines—Page Milk Company

Gas, boiler make-up, condensate, and boiler feed lines—Oxford Paper Company



Overhead heating coils
Savage Arms Corporation

Pipe, sheets and plate in aerial condenser
Duquesne Brewing Company



Vents, steam supply and return, and waste lines—Standard Brands, Inc. of California

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Boiler breeching—Beltsville Laboratories, Department of Agriculture

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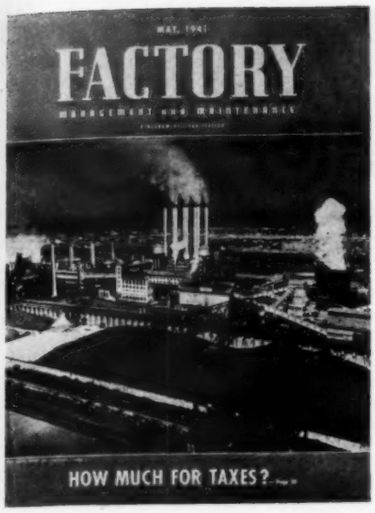

Very much in the news early last month when United Auto Workers (CIO) tied it up. Off Page 1 only 10 days later when 20,000 maintenance and supervisory employees began to ready it for resumption of operations. The strike shutdown at Ford's River Rouge plant was one of the quietest in auto labor history. Skillful mediation made it also one of the shortest, the skillful mediator being from the U. S. Conciliation Service (FACTORY, Feb., 1941, page 42). Kodachrome by courtesy of Ford Motor Company.

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FACTORY

MANAGEMENT and MAINTENANCE

MAY, 1941

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FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Put It Up to the Machines

MORE PRODUCTION, now needed so badly, can be had by working our machines longer hours. Machinery is not limited to an eight-hour day. In fact, most machines can be operated 24 hours a day for fairly long periods. That is true of metal-working machines in particular; and it is by means of metal-working machinery, principally, that our defense objectives will be attained.

So the 120-hours-a-week plan, originated by personnel of the Office for Production Management, and adopted last month by the Army, Navy, and OPM, seems to be a sensible attempt to get the greatly increased defense production that is vitally necessary. This plan also should go far toward solving the guns-and-butter problem. Successful application of the plan would eliminate the need for much plant expansion that would unnecessarily use up present productive capacity and add to post-war problems.

The 120-hour plan looks toward the complete utilization of the productive capacity of the nation's metal-working equipment. Plants engaged on non-military production, but whose facilities can be utilized to make military goods, will be expected to operate on the 120-hour basis. As rapidly as they can take on the production of military goods, their hours will be stepped up. However, they will not, for the time being, at least, be expected to devote to the production of military goods any part of the 40 or 44 hours which surveys show they now devote to the manufacture of non-military goods.

Scarcity of materials, conceivably, might make the 120-hour plan impossible. Then, if the production of materials could not be stepped up enough, or substitutes could not be found, the 120 hours would have to be revised downward until such time as the deficiencies had been made good.

Lack of workers to man the machines should not nullify the plan. According to most estimates there are several millions of employables still unemployed. Lack of *trained* workers might provide a considerable brake on putting the long week into operation.

Widespread use of the subcontracting, or farming-out, system could go a long way toward automatically introducing the 120-hour plan. Actually, it is hard to see how the plan can work at all unless farming-out is carried on extensively. OPM evidently fully appreciates this and is taking steps to get such widespread adoption of subcontracting as will make the 120-hour plan effective throughout the country.

Direct contractual arrangements can be made by the armed forces with only a few prime contractors. From there on, in the interest of speed and efficiency, the prime contractor and the subcontractor must carry on if full utilization of productive capacity is to be achieved.

The request of OPM, Army, and Navy for a 120-hour week really is another call for speeding up production. Unlike some of the earlier calls, which were characterized by hysteria, this one is highly constructive. It tells how the speed-up can be achieved. It should receive immediate and wholehearted response from industry in the form of increased farming-out arrangements and expanded training activities.

L. C. Morrow

How Much for Taxes?

We, the American people, have filled out a national defense check for the staggering sum of $40,000,000,000. Now we are casting about for the means to make it good. The decisions on tax policy that are in the making today may vitally affect the economic destiny of the nation and of the individual for generations to come.

Thus the eyes of every American who works for a living are on Washington where Congress is pondering a tax bill to meet the vast, unprecedented expenditures of the coming fiscal year. In that period at least $12,000,000,000—and perhaps much more—of the $40,000,000,000 will be spent over and above $7,000,000,000 of regular peacetime government costs.

The Danger of Debt

How much shall we raise by taxation? How much shall we borrow? How much *should* we pay in taxes? How much *should* we borrow? Is an excessive national debt dangerous to our economic future? What can we learn from history? What can we learn from the example of modern democracies at war? How weigh one policy against another in terms of the ultimate welfare of our industries and our citizens?

What are the short-range advantages of moderate taxation and what are its perils? What can we gain by economies in peacetime expenditures? What psychological and political factors will affect the decisions of Congress? As an aid to the reader in his study of the fast-developing debate at Washington, FACTORY has discussed these and other questions in off-the-record consultations with officials and tax economists in Washington and Wall Street.

By all signs, the present 4 percent *basic* individual income tax rate will be raised to a figure not exceeding 8 percent in the new tax bill. (See chart on page 54). The 24 percent corporate income tax rate seems likely to rise to 30 percent, while maximum excess profits taxes may reach 75 percent.

These rates, the highest we have ever paid, may seem formidable to us, yet they will be extremely light—the personal income levies especially—by comparison with the desperately big burdens borne by Europeans and even by comparison with the load we ourselves will carry in the future. Some taxpayers may see a certain short-range advantage in moderate tax levels this year. But conservative tax economists believe that if citizens were alert to their own long-range interests they would storm Washington to demand:

1. Higher taxes here and now.

2. Drastic economies in non-defense expenditures.

And in every state capital, city, and hamlet, the aroused taxpayers would unite in a determined day-and-night drive for more efficient and less costly local government.

For America already stands face-to-face with the inevitable fiscal dilemma of war. We are building a mighty mountain of debt that will have less and less chance of being amortized because of a terrific and rising overhead.

Somewhere, not far ahead, perhaps, may lie the point at which the public credit becomes exhausted and the piper must be paid in cash. At all events, the predictable consequence of over-borrowing is the false stimulus of inflation which, if it takes an extreme form, may be followed by national bankruptcy, prolonged depression, ruinous taxation, and possible economic upheaval. This, at least, is the lesson of history.

A Big Obligation

To postpone the day of reckoning is merely to aggravate the consequences. In fact—

"Every dollar that we fail to pay or save this year will cost us two dollars in the years to come," one of America's outstanding tax economists told FACTORY. "We can borrow, we *must* borrow, but we should strive by might and main to hold borrowing to the absolute minimum."

We seem not too certain to succeed. Already, in this war in which we are not engaged, our proposed defense expenditures of $40,000,000,000 are a sum equal to the total cost of the federal government from George Washington to the second Wilson administration including the first year of the World War, a sum which would gird the equator with a band of dollar bills 165 dollars wide.

We have, moreover, virtually agreed to pay some of England's taxes, for that is one of the effects of the lend-lease agreement. *But are we planning to pay our own?* True, we pay plenty of taxes now. Federal, state, and local combined, they take 20 percent of our national income. Yet present taxes would scarcely cover the bottom of the bucket. The $40,000,000,000 represents an obligation of $6,153 for every one of the 6,500,000 income tax paying citizens of the United States—a figure which grossly oversimplifies, yet illuminates, the magnitude of the problem.

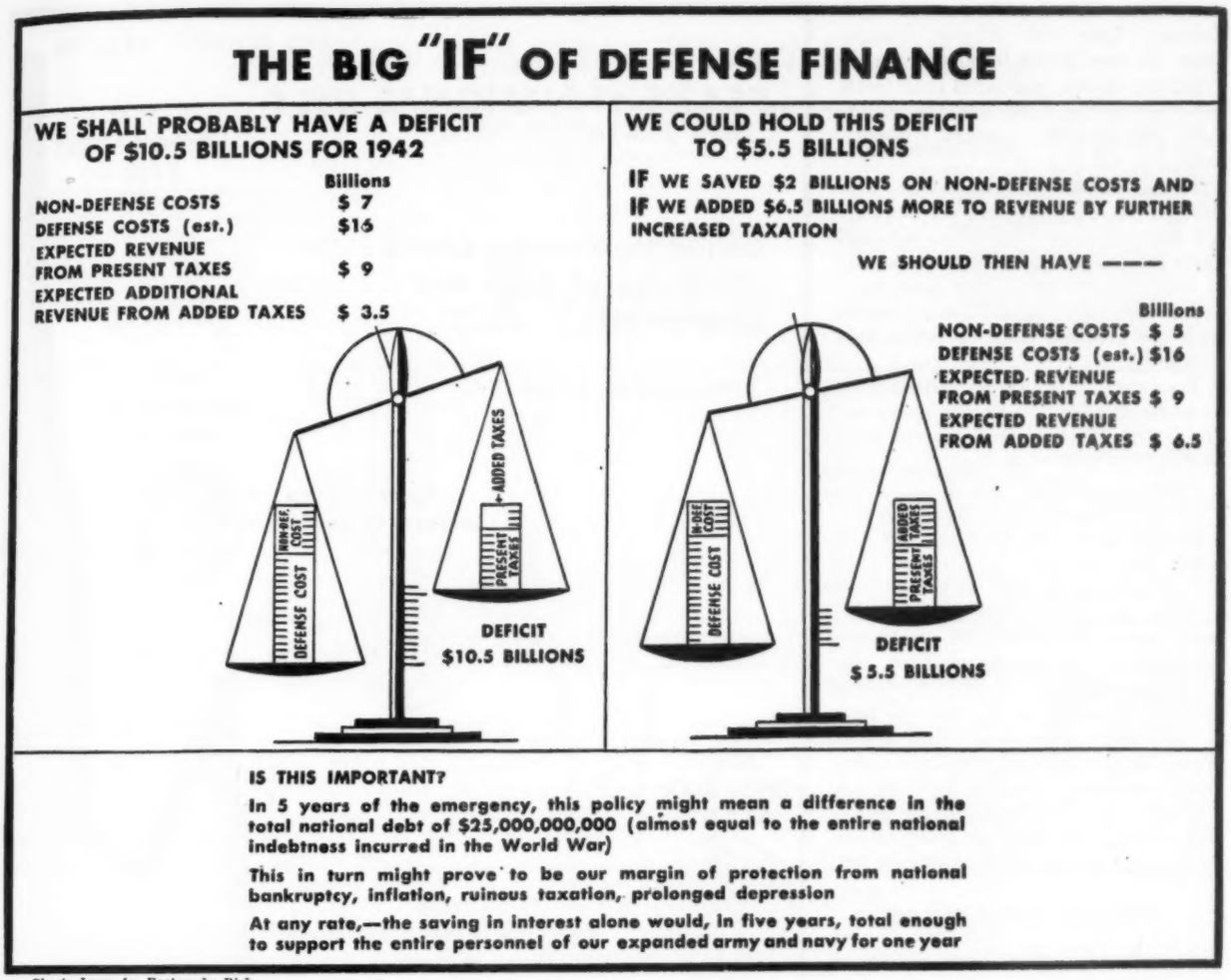
Bear in mind also that the $40,000,000,000 may only be the beginning. It is the estimated cost of defense, not of war. England, despite all the help she gets from the Dominions and from us, is now spending $340 per capita annually for war in comparison with the approximate $123 we expect to spend for defense in the coming fiscal year when production hits its stride. This is one more argument for battening down our fiscal hatches and steering a clear course toward economic stability through any storm that may blow.

What Sacrifice Means

In the eyes of certain extremists it has already become "unpatriotic" to mention economy or to doubt the wisdom of a governmental decision. This article is a discussion of national policy, nothing more. It should still be possible to question the judgment, without impugning the sincerity, of the officials and legislators who today must decide questions affecting the welfare of the nation for generations to come.

The prime question is simply this: What measures of economic self-discipline and sacrifice must we, as a people, adopt to insure the survival of the democratic liberty we are striving to defend? Secretary of the Treasury Morgenthau recently indicated that the new tax bill should provide new levies to yield $3,500,000,000 in additional taxation. This was both a bombshell and a reassurance. Previously it had seemed that an increase of only $2,000,000,000 was contemplated.

But will $3,500,000,000 be enough? Admittedly it can be increased further in an intensified emergency. If we are indeed on the brink of war, we may assume that the war psychology will induce a greater public disposition to sacrifice. But is the public not ready *now* for greater sacrifices than Congress


THE BIG "IF" OF DEFENSE FINANCE
WE SHALL PROBABLY HAVE A DEFICIT OF $10.5 BILLIONS FOR 1942
Billions
NON-DEFENSE COSTS $ 7
DEFENSE COSTS (est.) $16
EXPECTED REVENUE FROM PRESENT TAXES $ 9
EXPECTED ADDITIONAL REVENUE FROM ADDED TAXES $ 3.5
NON-DEF. COST
DEFENSE COST
PRESENT TAXES
ADDED TAXES
DEFICIT
$10.5 BILLIONS
WE COULD HOLD THIS DEFICIT TO $5.5 BILLIONS
IF WE SAVED $2 BILLIONS ON NON-DEFENSE COSTS AND IF WE ADDED $6.5 BILLIONS MORE TO REVENUE BY FURTHER INCREASED TAXATION
WE SHOULD THEN HAVE ———
Billions
NON-DEFENSE COSTS $ 5
DEFENSE COSTS (est.) $16
EXPECTED REVENUE FROM PRESENT TAXES $ 9
EXPECTED REVENUE FROM ADDED TAXES $ 6.5
N-DEF COST
DEFENSE COST
ADDED TAXES
PRESENT TAXES
DEFICIT
$ 5.5 BILLIONS
IS THIS IMPORTANT?
In 5 years of the emergency, this policy might mean a difference in the total national debt of $25,000,000,000 (almost equal to the entire national indebtness incurred in the World War)
This in turn might prove to be our margin of protection from national bankruptcy, inflation, ruinous taxation, prolonged depression
At any rate,—the saving in interest alone would, in five years, total enough to support the entire personnel of our expanded army and navy for one year

Charts drawn for Factory by Pick

proposes to ask? And does not sacrifice entail, in fact *necessitate*, the sharp reduction of non-defense expenditures?

Let us see what sacrifice really means to nations at war. Great Britain, burdened by debt though it is, is paying about 40 percent of its war costs out of taxation, Canada 50 percent, Australia over 90 percent. Our present revenues, after payment of non-defense costs cover only about 20 percent of our defense expenditures. We shall increase that to 47 percent *if*, but only if, Secretary Morgenthau is correct in assuming that defense will cost us only $12,000,000,000 in fiscal 1942.

For married men with two children, the current tax on an income of $5,000 is: United States, $75; Canada $391; Australia, $1,052; England, $1,196. Under the new British tax bill, the Englishman will pay $1,654, however, because the 1942 base rate will be 10 shillings to the pound, or 50 percent. Personal exemptions will avail the Englishman but $960 against the American's present $2,800. The middle-bracket British income carries the brunt of the burden. Under the new rates, married men with two children will pay $4,304 on $10,000 and $11,209 on $20,000.

But the middle brackets cannot bear the load alone. Hence married and single persons alike in England will now pay direct taxes on incomes as low as $440. Part of the levy on lower incomes is taken in the form of enforced war savings, to be returned by the government at the war's conclusion. The maximum of such returns that any taxpayer can claim, however, is $260 on all taxes paid during the entire war.

Only $28,000 to Spend

The new lower exemptions bring an additional 2,000,000 English taxpayers into the picture, to help out the wealthy who have long since been taxed to the point of diminishing returns. Under the new rates a man with an income of $600,000, if such there breathes, would pay $585,000 or 19 shillings to the pound (20 shillings). This is an extreme instance, but it is a fact that England's wealthy classes have been all but "liquidated." No Briton, whatever his income, can have more than $28,000 to spend after payment of taxes.

Now, why, even in view of the magnitude of its war load, must England strain so much harder than the Dominions to meet any large part of the burden by taxation? One answer is that England *began* the war with a staggering national debt, plus high taxes. This brings us to a big feature of our own tax problem which Americans will do well to remark. (See chart on page 53.)

The United States missed, in 1917–19, a splendid chance to fight a war on a pay-as-you-go basis. We went into the World War with a national debt of $2,900,000,000. Despite war taxes that seemed high at the time, we emerged with a debt of $25,500,000,000 and thereby sowed the seeds of much future distress. Some $15,000,000,000 remained unpaid when the depression set in, and remains unpaid today. This cost us $300,000,000 in interest last year. In the years since the depression, we have built a huge bureaucracy. We have tripled the national debt. Interest on loans is a major feature of the British problem, and it is likewise one of the things we have most to fear from overborrowing. If our debt climbs to $100,000,000,000 as many economists fear that it may, interest rates are likely to

climb also. Call them conservatively 3 percent. Then our interest charges alone become $3,000,000,000 annually—$22 per capita, compared to 23 cents in 1916. In short, we are one of the "old" debt-ridden nations, fiscally, today.

Thus, obviously, if we adopt taxes that merely *seem* high and fail to do the job that war taxes should do, we shall again be deluding ourselves as we did in 1917–19. We should not again swallow new overdoses of debt, sugar-coated with the pleasing taste of inflationary prosperity.

Just what, as Congress settles down to study the tax bill, is the prospect? Here is the picture as Secretary Morgenthau outlined it on April 17:

Expenditures, $19 billions.

Income from old taxes, $9 billions.

Income from rate increases and new taxes, $3.5 billions.

To be borrowed, $6.5 billions.

Since non-defense expenditures will total about $7,000,000,000, Secretary Morgenthau apparently assumes defense expenditures of $12,000,000,000 a year. Anything above that will have to be added to the debt. And a very strong sector of expert opinion holds that defense expenditures—already nearing a $10,000,000,000-a-year clip—will climb far above $12,000,000,000 under the impetus of the lend-lease bill.

Treasury Often Wrong

The Treasury has been wrong so often—both in over-estimating and under-estimating the deficit—that anyone is entitled to match a guess against its calculations. Let us then assume defense expenditures of $16,000,000,000. This would change the Treasury's picture as follows:

Expenditures, $23 billions (non-defense $7 billions, defense $16 billions).

Income from old taxes, $9 billions.

Income from rate increases and new taxes, $3.5 billions.

To be borrowed, $10.5 billions.

A deficit of $10,500,000,000 would hardly be considered safe in a single year for a nation on the verge of expenditures that may easily eclipse any so far foreseen. The $3,500,000,000 tax increase would be of little avail even if it were accompanied by severe economies in non-defense costs. (Two billions is the sum most frequently suggested.)

Still assuming defense costs of $16,000,000,000, what is the program that conservatives recommend as one most likely to preserve us from the perils of inflationary borrowing? A consensus of the more cautious economists would suggest something like this:

Expenditures, $21 billions ($16 billions for defense and $5 billions for non-defense, a saving of $2 billions in the latter).

Income from old taxes, $9 billions.

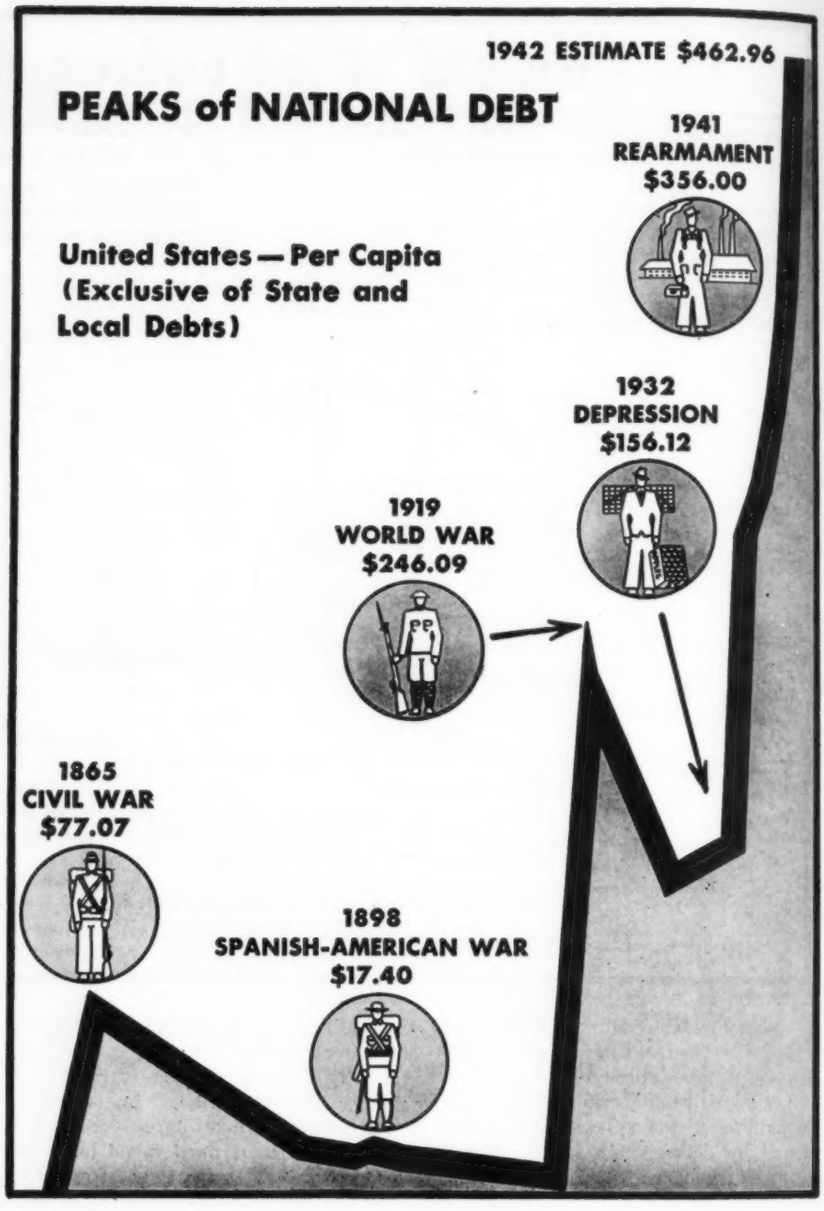
Income from rate increases and new taxes, $6.5 billions.

To be borrowed, $5.5 billions.

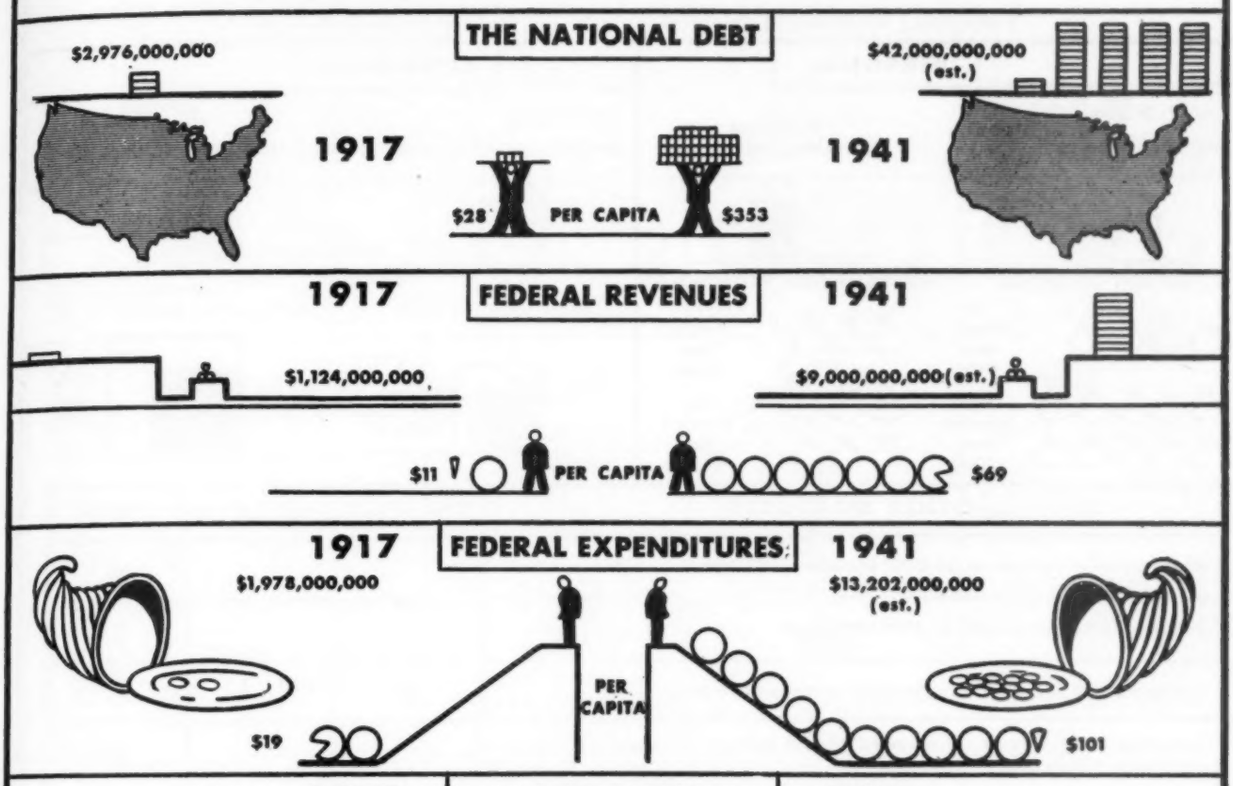
That makes a deficit $5,000,000,000 smaller than the Morgenthau program would produce in the same situation. And in five years that might mean a total difference in the national debt of $25,000,000,000—a sum almost equal to the cost to us of the World War, a sum on which *the interest alone* would, in five years, total enough to support the entire personnel of our enlarged Army and Navy for twelve months. (See chart on page 51.)

A plan to insure a deficit no greater than $5,500,000,000 on an expenditure of $21,000,000,000 might well prove to be our margin of protection against inflation and upheaval. It is not, to be sure, 100 percent pay-as-you-go. But a rigid program of higher-tax-*plus*-economy would represent a turning point in national policy. Adopted now, it might prove to be the juncture from which historians would chart the course of America's survival as a capitalistic democracy.

There are signs also that the public would readily submit to more severe taxation. A survey of opinion, covering citizens of every income class and political hue, demonstrated this as early as January even before the full scope of the defense program was realized. This survey, conducted by the National Association of Manufacturers, asked the question: "How do you think the government should raise the money to pay


1942 ESTIMATE $462.96
PEAKS of NATIONAL DEBT
United States — Per Capita (Exclusive of State and Local Debts)
1941 REARMAMENT $356.00
1932 DEPRESSION $156.12
1919 WORLD WAR $246.09
1865 CIVIL WAR $77.07
1898 SPANISH-AMERICAN WAR $17.40

WE HAD A BETTER START IN 1917



1917	TAX RATES	1941
	PERSONAL	
2% ON FIRST $2,000 NET 4% ON BALANCE OVER $4,000	BASE RATE	4% ON ALL NET INCOME
1% ON $5,000 GRADED UPWARD TO 63% ON $2,000,000	SURTAX	4% ON $4,000 GRADED UPWARD TO 74% ON $2,000,000
NONE	DEFENSE TAX	10% OF NET TAX
	CORPORATE	
6% ON NET INCOME	NORMAL RATE	24% FOR CORPORATIONS EARNING $25,000 AND MORE
20% TO 60%	EXCESS PROFITS TAX	25% TO 50%
NONE	CAPITAL STOCK TAX	$1.10 PER $1,000
10%	UNDISTRIBUTED PROFITS TAX	NONE

Despite our relatively favorable position in 1917, we rolled the national debt up to $25,482,000,000 by 1919 by borrowing rather than attempting to keep the war on a pay-as-you-go basis. Some $15,000,000,000 of this indebtedness remains unpaid today and costs us, this year, about $300,000,000 in interest.

What policy will we follow today, when we begin with debts and taxes so much higher? Will we economize and increase tax rates now? Or will we borrow again and trust to the future to pay the piper?

WHAT TAXES WILL BE PAID IN 1942?

Following figures reflect opinions of Leading tax economists on the probable new tax rates, to be adopted by Congress in tax bill now under discussion. These are *opinions only* subject to sudden change, especially if the United States becomes an active participant in the war

PERSONAL

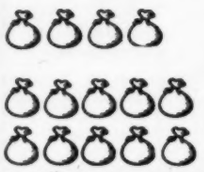
PRESENT BASE RATE

4%

PROBABLE MAXIMUM NEW RATE

8%

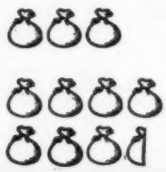
PRESENT EXEMPTION



For Single Man $800

For Married Man $2000

PROBABLE NEW EXEMPTIONS



For Single Man $600

For Married Man $1500

CORPORATE

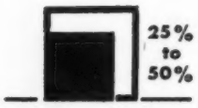
PRESENT NORMAL RATE

24%

PROBABLE NEW NORMAL RATE

30%

PRESENT EXCESS PROFITS RATE



25% to 50%

PROBABLE NEW EXCESS PROFITS RATE

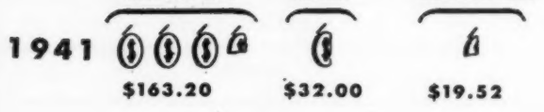
40% to 75%

OTHER MEASURES	UNLIKELY	POSSIBLE	LIKELY
Begin personal surtax at $3,000, instead of $4,000			✓
Increase surtax on $5,000 to $100,000 group			✓
Single method for figuring corporate excess profits tax	✓		
Lowering of 8% credit for invested capital method of figuring corporate excess profits tax			✓
Lowering of average-earnings credit (now 95% of base period average) in figuring corporate excess profits tax		✓	
Change in capital gains and losses provisions	✓		
Increased excise taxes on spirits, beer, wines, soft drinks, including $1.00 per gallon on liquor			✓
New excise taxes on other luxury goods			✓

WHAT PROBABLE BASIC RATE CHANGES MAY MEAN

PERSONAL

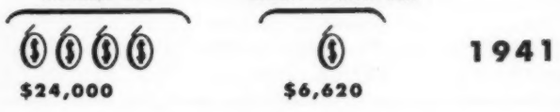
INCOME $7,200 — WIFE — ONE CHILD



Each symbol equal to $50

CORPORATE*

NET EARNINGS $100,000

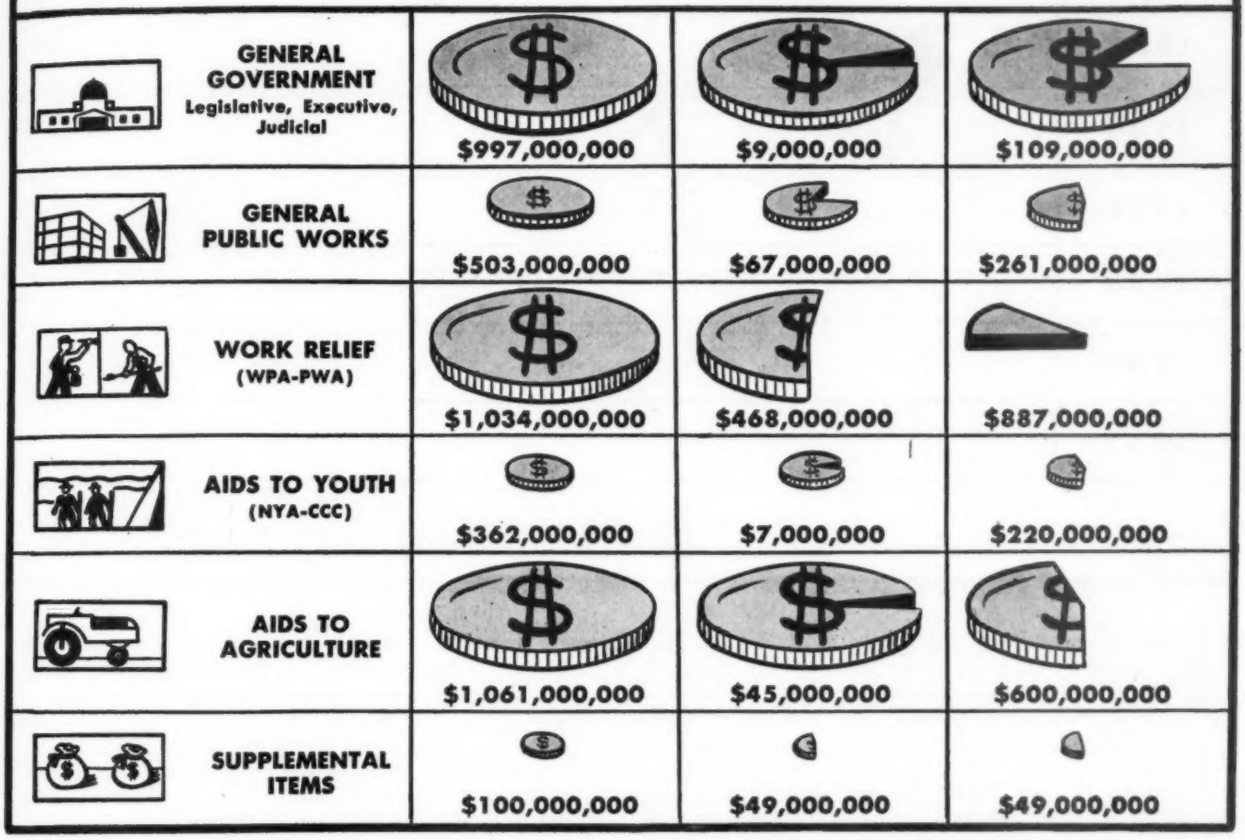


Each symbol equal to $6,000

*Excess Profits Tax figured on 1936-39 Average Earnings of $60,000

WHERE NON-DEFENSE COSTS CAN BE CUT---

(Recommendations of the National Economy League)



for national defense?" The reply of 55 percent was "By taxation." Only 5 percent said, "By financing."

Incidentally, the NAM poll revealed strong sentiment for a national sales tax. This was more than confirmed by a later Institute of Public Opinion (Gallup) survey which showed an actual majority for a 2 percent levy on sales. Senator Johnson of Colorado, returning from a trip to the West, reported with some astonishment that he had "never seen people so willing to be taxed as they are at present."

"We ought to accommodate them," he added.

Why not? Why has there been so little tendency in Washington to take extra steps to insure us against inflationary borrowing? The official apathy toward economy is easy to explain, of course. As for borrowing, it may continue to find support as a policy for two reasons.

First is the so-called "national income" or "spending" theory of deficit financing, which holds that government spending, followed by increased production, will in turn generate increased national income which in time will cover the tax cost of spending. The "national income" group has been out of the saddle for some time now but the idea dies hard and still has plenty of supporters—all unmindful of the maxim that "those who live by hope may die by despair"—who may be on top again before long.

Forced Savings a Tax?

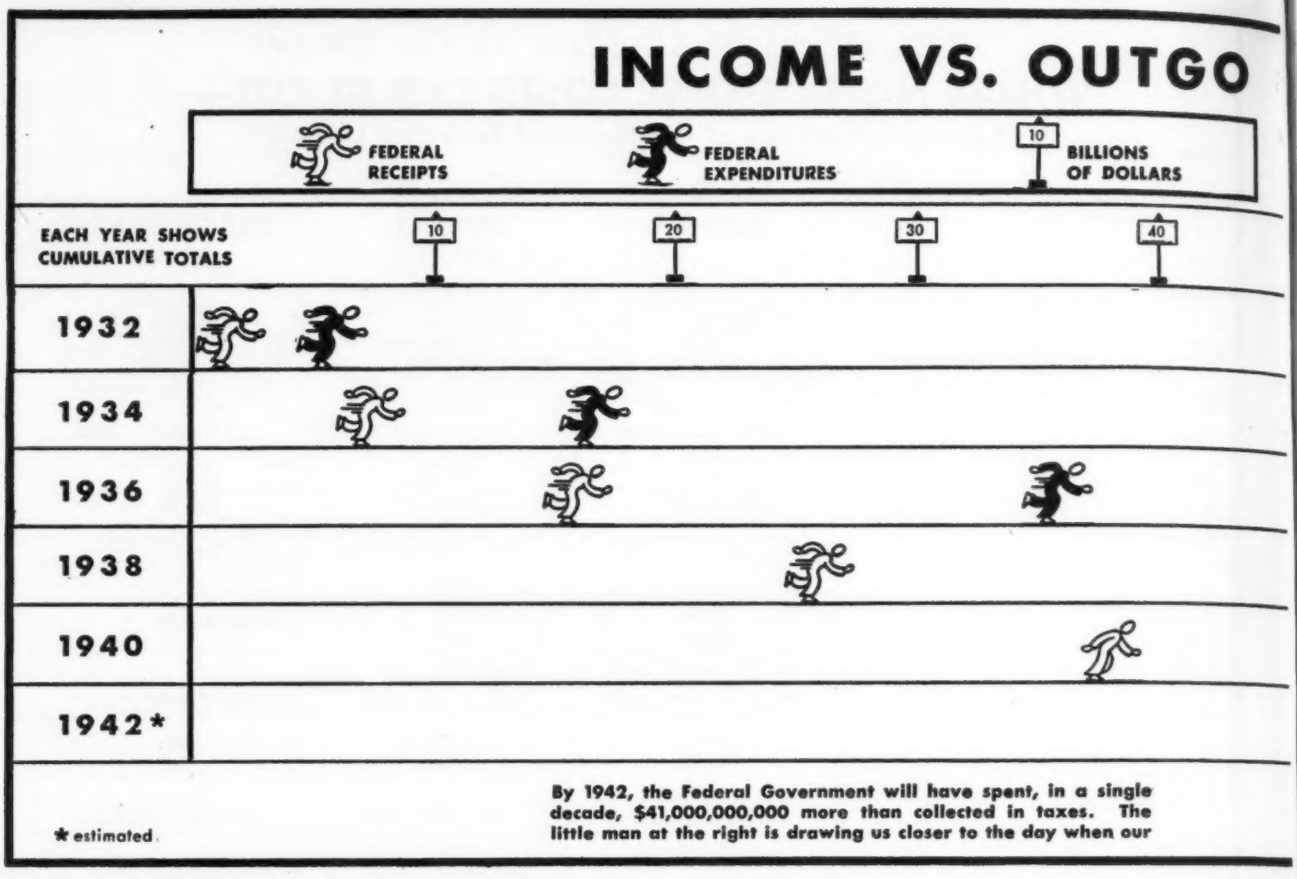
Second is the belief, in official quarters, that the new savings bonds just launched may bring in as much as $3,000,000,000 and thus obviate an equal amount of bank borrowing.

The testimony of conservatives is discouraging to both ideas. As for national income, the generally accepted figure at which we might "break even" on taxes is $100,000,000,000. Last year the national income was $74,000,000,000. Undoubtedly it should be much higher this year. But can it reach $100,000,000,000?

"Not without price inflation," the conservatives say.

As for the savings bonds, many experts believe they are offered at interest rates too low to attract any large amount of investment. Admittedly funds siphoned from personal savings are preferable to bank borrowing because they do not create new credit. They also serve as a check against the accumulation of inflationary buying power in the hands of consumers. They are being used—now on a compulsory basis—in England fully as much for that reason as for the funding of the war effort.

"But compulsory savings are really a form of tax," one economist told FACTORY. "England has made no plans for repaying this debt to the people. If, after the war, a capital levy is adopted,



as has been suggested, it will simply amount to a bookkeeping transaction by which the bondholders, in effect, repay themselves. If other loans are employed to repay savings, inflation may result. Thus, finally, compulsory savings may at best prove to be a means of postponing, not avoiding inflation."

United States Treasury officials have already initiated discussion of a plan under which $10 would be taken weekly from a $50 pay envelope, $5 as a gross income tax and $5 to purchase government bonds maturing in 10 years. But this seems a remote possibility for the present.

What, then are the means by which Congress will cast about for Mr. Morgenthau's suggested $3,500,000,000 increase in revenues?* Obvious probabilities are the doubling, or more, of the basic individual income tax rate of 4 percent, the lowering of the $2,000 (married) and $800 (single) personal exemptions, the increase of the corporation base rate from 24 to 30 percent, upward revision of the excess profits tax rates perhaps to a maximum of 75 percent, and increased liquor and luxury excise rates averaging about 25 percent.

* Committee hearings had barely begun at the time of this writing and the public was still awaiting President Roosevelt's statement on taxation.

At long range, two factors bear heavily on Congressional psychology. First there has been little real public pressure either against borrowing or for economy. This year, therefore, Congress will hardly feel tempted to go much beyond the Morgenthau compromise in increasing revenues. Second, next year heavy borrowing will definitely appeal to Congressmen because of the general election, unless, miraculously, public fear of deficits should develop faster than Congressional fear of unpopularly heavy taxation. Our entry into active war would, of course, nullify the influence of these factors.

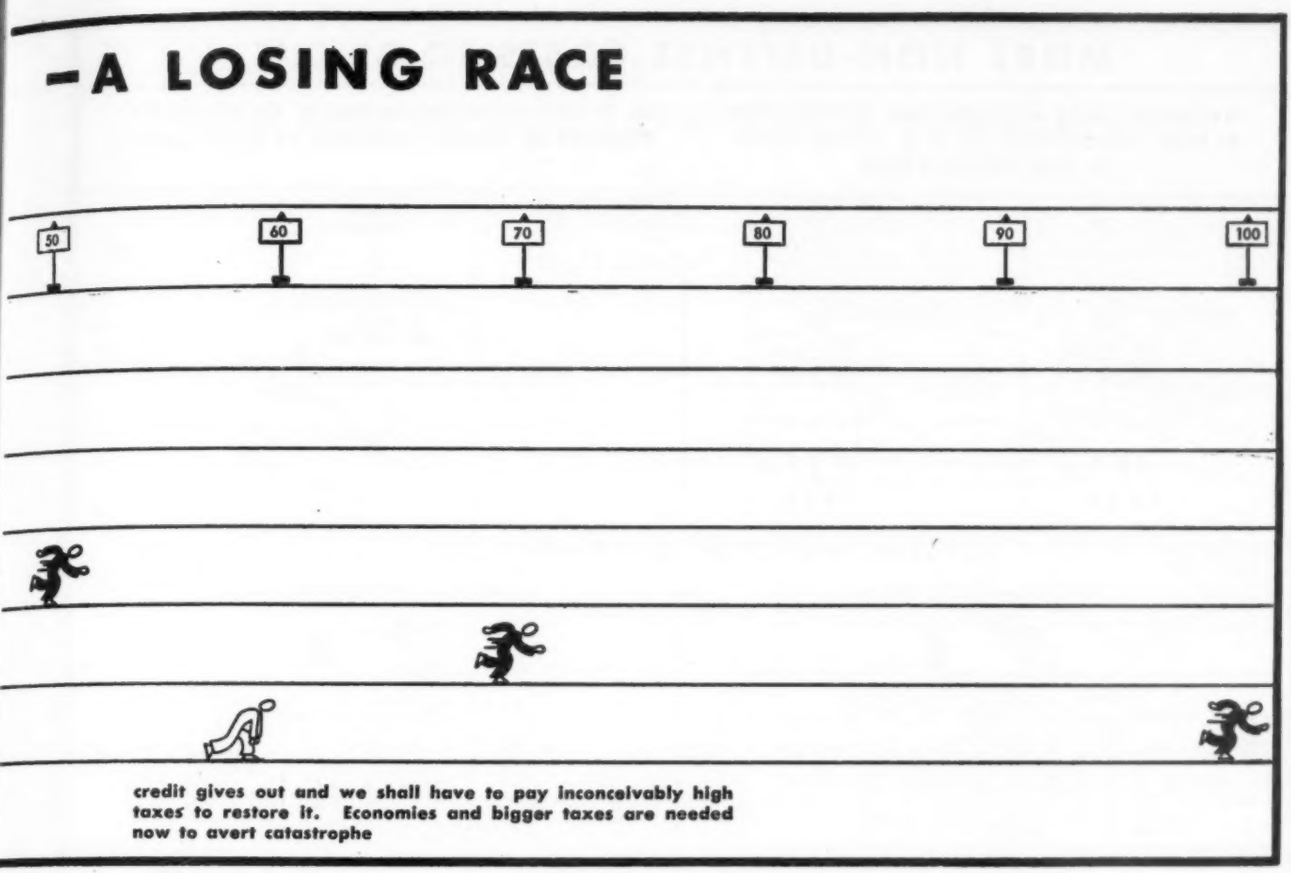
Trial Balloons

With the expected increases in income, liquor, and luxury taxes, Congress should get more than half of the $3,500,000,000 and so, in making up the difference, can experiment with other measures, laying the groundwork for the more drastic levies of the years to come. Trial balloons are soaring over Capitol Hill in such a cloud that it is difficult to estimate their relative significance. One surprising development is the sentiment for a national retail sales tax which, at 2 percent, might bring in the better part of $1,000,000,000.

The sales tax, however, has been set back by the President's expressed disapproval. It remains a possibility but must be listed among the measures that we identify with war, such as a gross direct tax on incomes at source, a capital levy, and 100 percent confiscation of excess profits. Of all these, the sales tax seems sure to be the first adopted when the time comes. Currently the far more probable trend is to higher gift and inheritance taxes, higher surtax rates, and lowering of the surtax exemptions as well as personal exemptions. The last may be dropped to $600 (single) and $1,500 (married).

In case of war, it is agreed, all bets are off for then practically no type of tax can be ruled out as impossible. In this connection, it will pay both industry and the individual to study certain legislation already proposed.

There are six nearly identical bills before Congress to "tax the profits out of war by steeply graduated income and other taxes in order to provide for an effective national defense, to promote peace, to encourage actual neutrality, to discourage war profiteering, to distribute the burdens of war, to keep democracy alive." Typical of these is H.R. 3690, sponsored by Representative Voorhis of California. Bills of this type are perennials. This one, however, unlike some of its more bombastic prede-


-A LOSING RACE
50
60
70
80
90
100
credit gives out and we shall have to pay inconceivably high taxes to restore it. Economies and bigger taxes are needed now to avert catastrophe

cessors, is thoroughly detailed procedurally, as though its authors meant business. Starting with a normal individual income tax rate of 6 percent on $500 (single) and $1,000 (married) it piles on heavy surtaxes, ranging from 10 percent on surtax net incomes above $3,000 to 50 percent on $20,000 and 93 percent on everything above $20,000. Corporations would pay 15 percent of income above 2 percent of capital stock value, plus 25 percent of income between 2 and 4 percent of capital stock value, and 100 percent of income above 6 percent of capital stock value.

This undoubtedly goes well beyond the requirements of pay-as-you-go. Yet in war-time such a bill might seem plausible. Consider the new English rates. An even more startling measure has been sponsored by Representative Whelchel of Georgia who proposes, in H.R. 3105, to "promote peace and the national defense through a more equal distribution of the burdens of war by drafting the use of money according to ability to lend to the government." This would enable Uncle Sam to borrow forcibly from the individual's net wealth (assets minus obligations) to the tune of 5 percent of "fortunes" between $1,000 and $10,000 on up to 70 percent of nest eggs amounting to $100,000,000 or more. These "loans" would be payable in *50 years*, and would bear taxable interest of 1 percent.

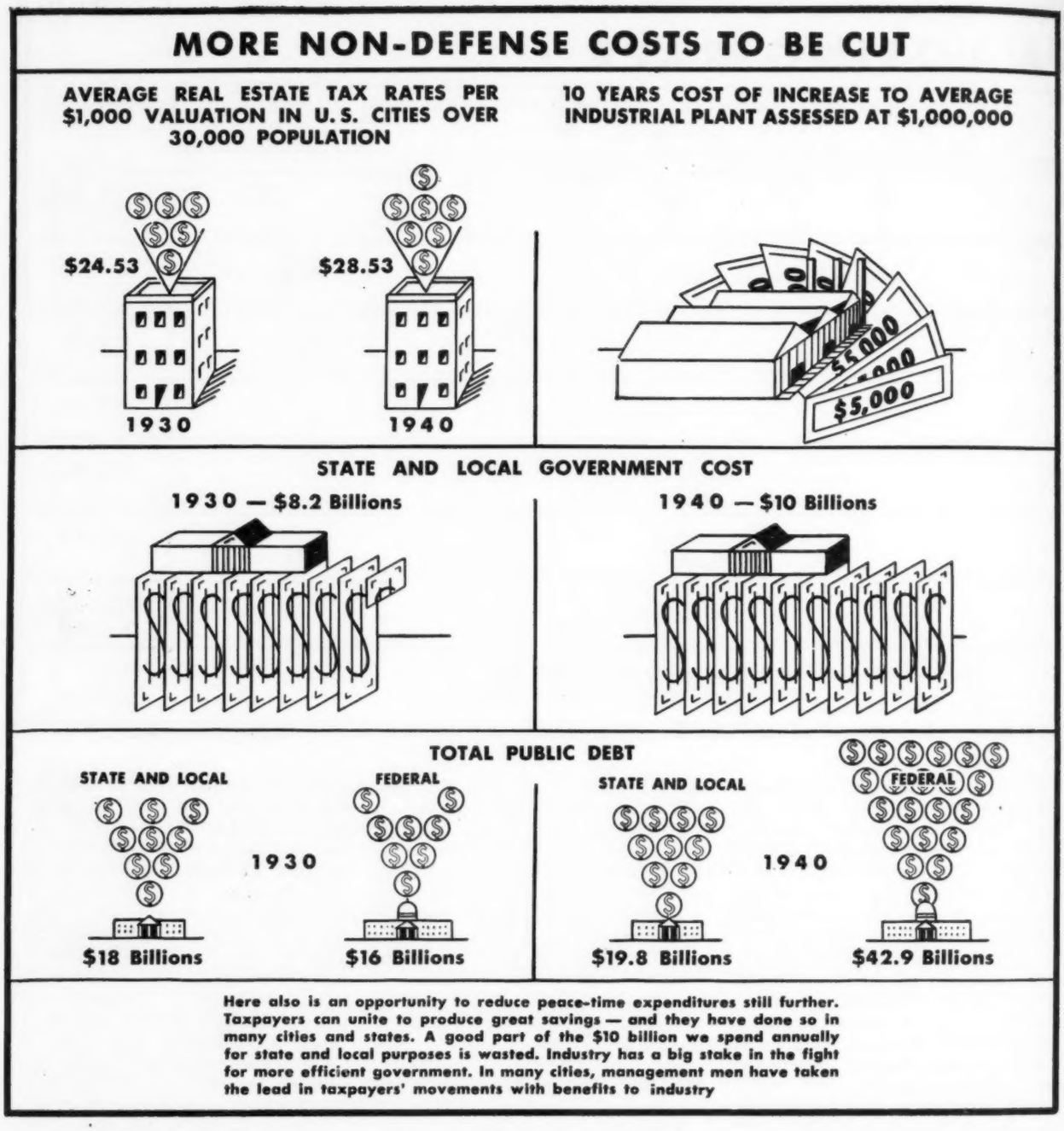
The mere existence of such bills gives food for thought, emphasizing again the need for keeping the government's financial house in some sort of order lest one day the forces of confiscation gain support on grounds of necessity. Little enough is heard from the forces of confiscation on the subject of economy, of course. But the citizen still has his chance to speak before the war psychology sets in for good.

The Will to Sacrifice—and Save

What savings *can* be made in government today? The easiest answer is *none* —unless the "national will to sacrifice" becomes aroused to such a degree that economy is imperatively demanded. Unquestionably the people are wide awake to the need for sacrifice on their own part but they have failed so far as the polls show, to connect this with the need for sacrifice on the government's part.

For one thing, lip service was paid to the idea of economy in the 1942 budget message. An apparent saving of $645,000,000 was made, but it comes down to $402,000,000, or less than 6 percent, when deduction is made for a $125,000,000 increase in interest on the debt and $118,000,000 of increases in other non-defense categories. Even the $402,000,000 seems less real when one reflects that at least $407,000,000 will be spent for "defense purposes" by non-defense agencies. Plain roads have become "defense highways" and plain ditches are now "defense waterways." It is a fact that boys are being taught farming and girls are being taught cooking in the name of defense.

The advocates of economy seem agreed that non-defense savings of nearly $2,000,000,000 could easily be made without crippling essential government services. The National Economy League's program (see chart, page 55) shows the way to such savings. Yet it appears that we shall spend 78 percent of 1938's relief, work-relief, and public works funds to take care of no more than 50 percent of 1938's total unemployed. We shall put $500,000,000 into new public works and buildings chiefly because Congressmen get no mail demanding an end to new post-offices and highways. While the Defense Housing Administration conjures cities into being, the United States Housing Authority will go on clearing slums. Have we asked ourselves whether some of these slums are not likely to be vacated by families on their way to new defense industrial centers? Meanwhile, the National Youth Administration will


MORE NON-DEFENSE COSTS TO BE CUT
AVERAGE REAL ESTATE TAX RATES PER $1,000 VALUATION IN U. S. CITIES OVER 30,000 POPULATION
$24.53
$28.53
1930
1940
10 YEARS COST OF INCREASE TO AVERAGE INDUSTRIAL PLANT ASSESSED AT $1,000,000
$5,000
STATE AND LOCAL GOVERNMENT COST
1930 — $8.2 Billions
1940 — $10 Billions
TOTAL PUBLIC DEBT
STATE AND LOCAL
FEDERAL
1930
$18 Billions
$16 Billions
STATE AND LOCAL
FEDERAL
1940
$19.8 Billions
$42.9 Billions
Here also is an opportunity to reduce peace-time expenditures still further. Taxpayers can unite to produce great savings — and they have done so in many cities and states. A good part of the $10 billion we spend annually for state and local purposes is wasted. Industry has a big stake in the fight for more efficient government. In many cities, management men have taken the lead in taxpayers' movements with benefits to industry

go on shamelessly competing for enrollees with the CCC and the Office of Education.

Aids to agriculture are budgeted at $1,061,000,000 this year, only $45,000,000 less than last year, despite the fact that 1941's farm income will be about $9,000,000,000, only $2,000,000,000 less than in 1929 when aids to agriculture were relatively negligible. What is far worse, the Senate Appropriations Committee actually voted a $445,000,000 boost in farm bounties above budget recommendations—a pure pork barrel deal which the House appears to have had the courage to kill.

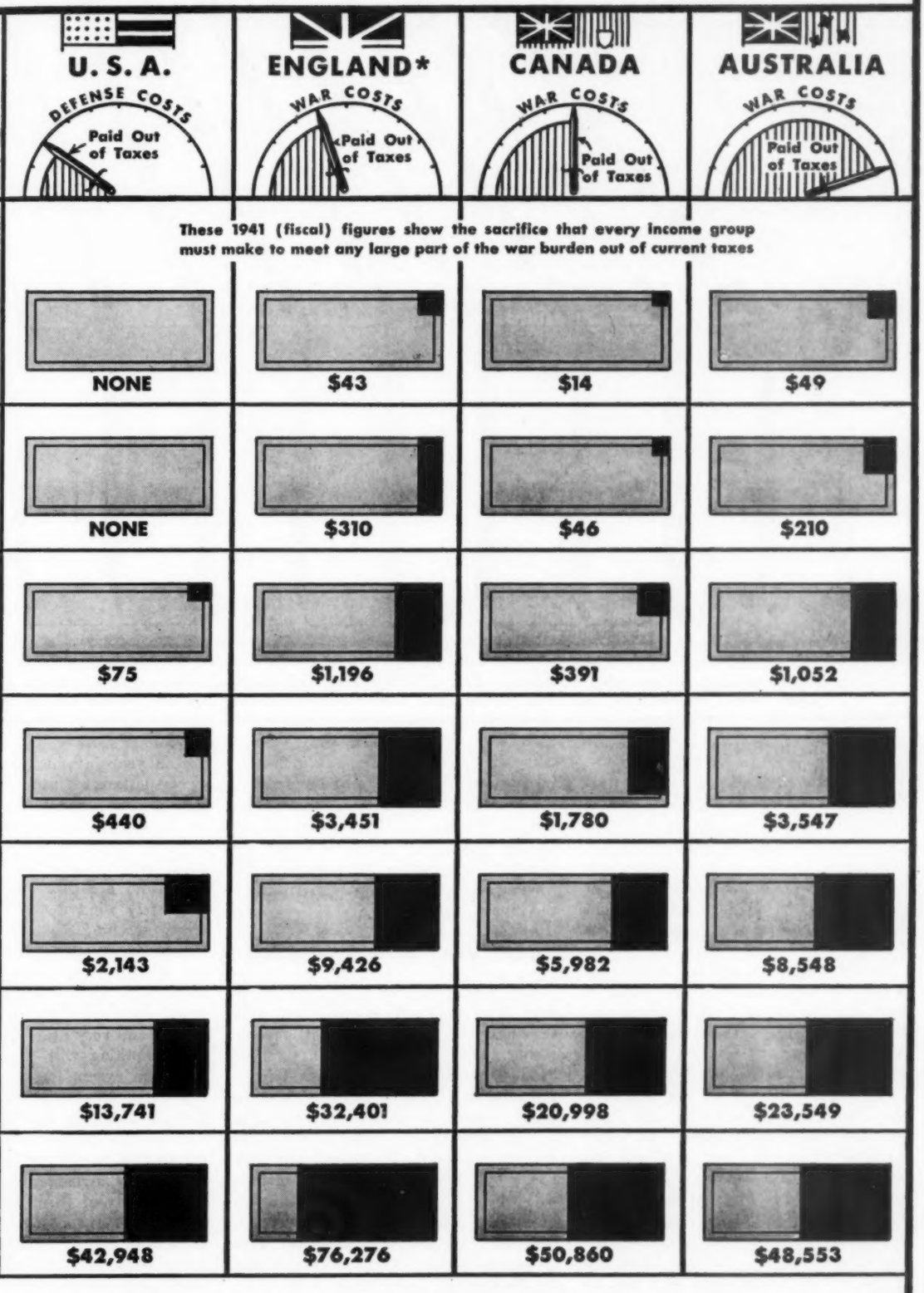
The absence of vigorous protest at this worst of all effronteries bespeaks a public, as well as a Congress, that is literally blinded to the value of millions by the dazzling splash of swift-flowing billions. Nobody seems to care about $2,000,000,000. What *is* $2,000,000,000 anyway?

Well, $2,000,000,000 is a line of 208 destroyers or a flight of 8,000 heavy bombers. Two billion dollars saved annually would, in five years, total $10,000,000,000. If the cities of Chicago, Philadelphia, Detroit, Cleveland, and Baltimore were suddenly bombed into extinction, $10,000,000,000 would just about rebuild them. *Finally, $2,000,000,000 is about what personal and corporate income taxes yielded to the government in 1939. Thus, a saving of $2,000,000,000 would mean a saving to you and the corporation for which you work about equal to the income taxes you both paid in that year.*

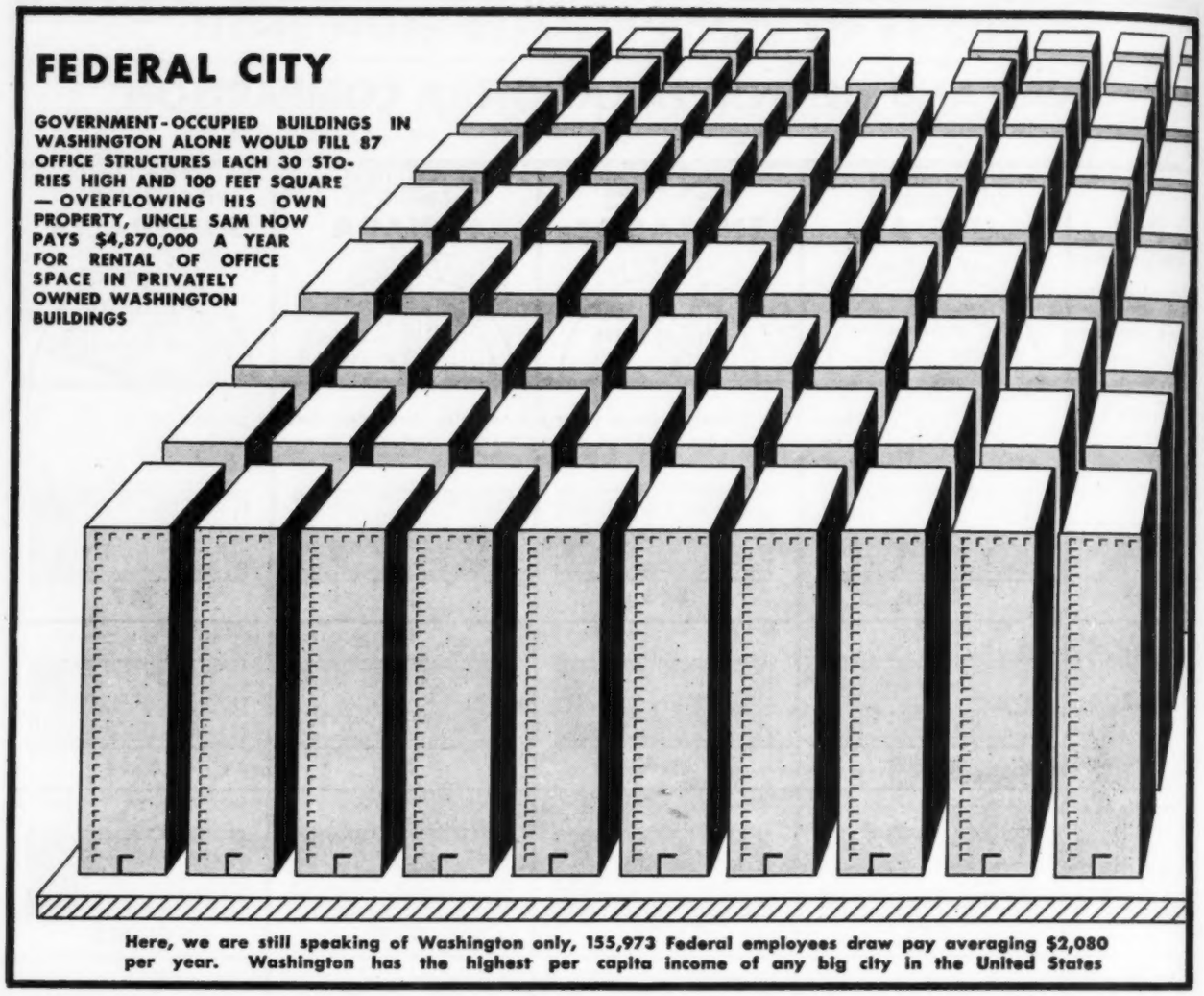
If the public ever awakens to this fact and awakens Congress to it we shall have great sport in running down the thousands of small economies that could produce enormous savings. Benjamin Franklin once observed that "little leaks sink big ships." The hull of our ship of state is criss-crossed with seams that need looking at.

"Aunt Sammy's Radio Recipe Book," for example, might be one of the things

WAR AND DEFENSE TAXATION: A COMPARISON



*Old rates — subject to increase of about 20% under new tax bill just adopted


FEDERAL CITY
GOVERNMENT-OCCUPIED BUILDINGS IN WASHINGTON ALONE WOULD FILL 87 OFFICE STRUCTURES EACH 30 STORIES HIGH AND 100 FEET SQUARE — OVERFLOWING HIS OWN PROPERTY, UNCLE SAM NOW PAYS $4,870,000 A YEAR FOR RENTAL OF OFFICE SPACE IN PRIVATELY OWNED WASHINGTON BUILDINGS
Here, we are still speaking of Washington only, 155,973 Federal employees draw pay averaging $2,080 per year. Washington has the highest per capita income of any big city in the United States

we could do without in an emergency. The modern equivalent of seeds, it is mailed free (though "priced" at 15 cents) to many hungry hundreds of thousands of Congressional constituents. It is yours for the asking—and be sure to write your Congressman today for your free copies of "Ice Cream Without Freezing" and "How to Trap Mountain Lions."

Better still, write and ask him to put a stop to such nonsense. Ask him to look into the gift of TVA fertilizer (intended for sale) to farmers; ask him why many bureaus relating to defense maintain labor relations advisors apparently duplicating OPM; ask him why the National Capitol Parks and Playgrounds Commission needs an extra $450,000 this year; ask him why the 1942 budget adds 335 new employees to the Railroad Retirement Board, 1,469 new employees to the Veterans Administration and only 35 to the State Department; ask him why the San Francisco World's Fair Commission still has an office and a telephone listing in Washington; ask him why no action has been taken on the TNEC's analysis of wasteful purchasing practices of the federal government; and ask him whether he intends to vote for the Rankin Bill to extend World War pensions to the dependents of veterans who were in no way disabled in the war. This passed the House last year.

Don't Stop; Start Scrutinizing

Little things all, but big in the aggregate. And don't stop there. Start scrutinizing your state and local governments. They are spending a total of $10,000,000,000 a year for non-defense purposes and some of this is wasted. In cities where industrial management leaders have taken a hand in the battle for efficient local government, industry has profited immensely by tax savings as real as any other cut in production costs. For information on the part you can play in the organized taxpayer movement, write to the Tax Foundation, 30 Rockefeller Plaza, New York.

Conclusion: This will be an experimental and crucial year in national taxation, a year in which we may set the whole pattern of future national policy for better or for worse, a year in which we have our choice—perhaps for the last time—between "taxing more, saving more, and borrowing less" or shilly-shallying into a policy whereby we shall ultimately wind up by taking in each other's washing.

If this happens, Congressmen will be far less to blame than the taxpayers themselves. Congress has had very little proof that the people want to avoid borrowing and very little incentive to economy. Nothing will convince the Congressman except the citizen who takes pen in hand to remind him of Adam Smith's assertion that the practice of funding has gradually enfeebled every nation that tried it or to call his attention to this arresting statement by Dr. Harley Lutz of Princeton:

"The sole purpose of the defense program is to make the nation strong. Bad fiscal methods will weaken it, and the more such methods are used in the struggle to become stronger, the weaker will the nation be in the end."

Storerooms on the Move

Bank or float for ring gear facing operations is provided by slides down which the parts move from one machine to the next in line

Endless overhead conveyors carry stock from one process to the next. Operators lose no time waiting for materials. Scheduling is far more flexible. No trucks, skid boxes, or materials clutter the floor, saving one-third the space

FRANK ELWELL

Works Engineer, Buick Division
General Motors Corporation
Flint, Mich.

UNIQUE IDEAS in materials handling and a considerable expansion of the common use of overhead conveyors, are embodied in assembly of front suspension systems and rear axle units for 1941 Buicks.

To begin with, a 1,550-ft., single-story building, 950 feet of which is new, is devoted to making these units. Twelve thousand feet of overhead conveyors connect the various machine groups within the building, and a 6,634-ft. overhead conveyor delivers the completed units to the final car-assembly point, 3,300 feet away. With a new building, and a single-purpose one at that, the arrangement of equipment and the placing of conveyors could be done to fit the specific job.

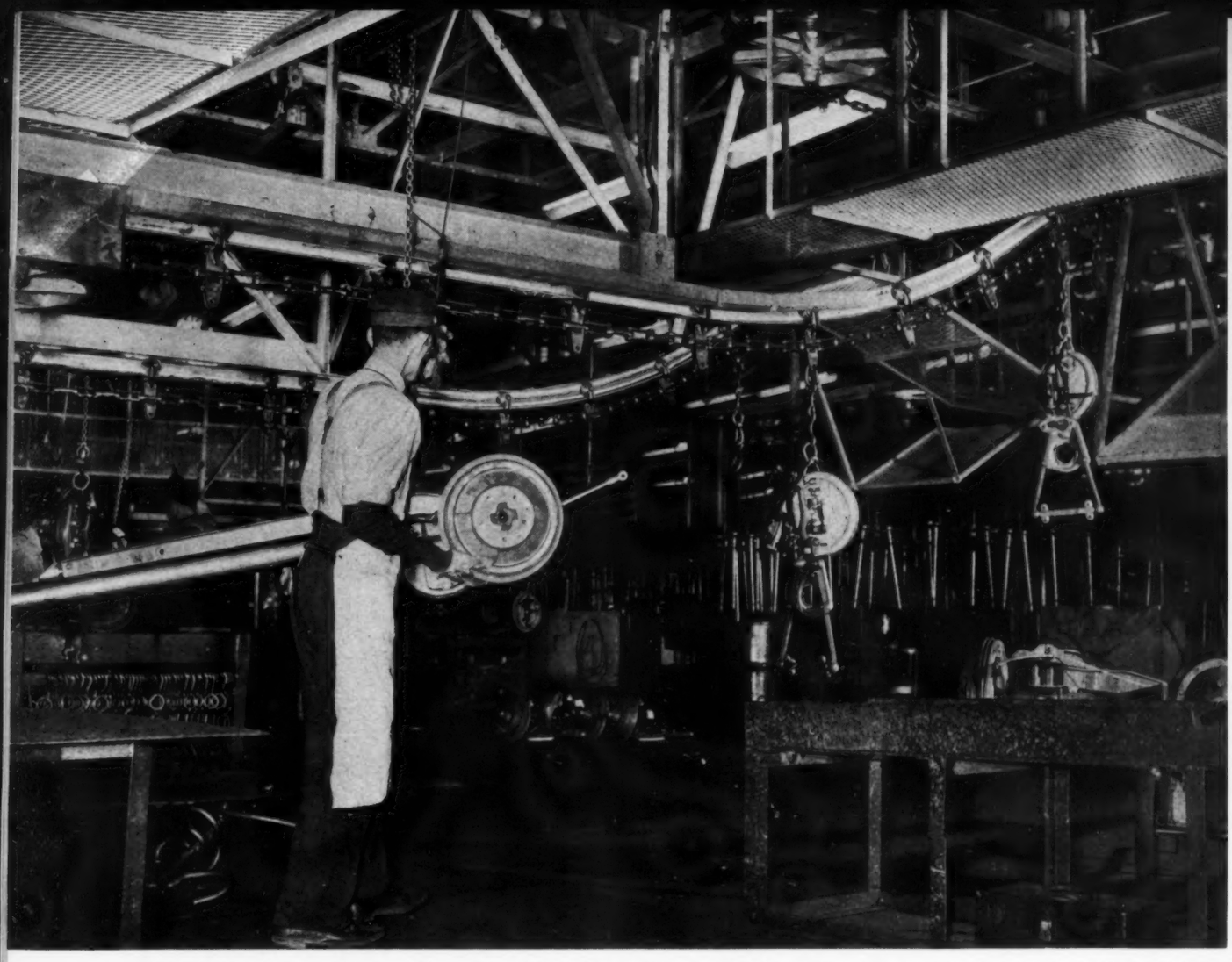
The building offered a challenge to the plant engineering and master mechanic departments—they could have everything just the way they wanted. There was no need to adapt equipment to a poorly shaped building, or to an existing layout. Two monitor sections, running the length of the building, divide the 138-ft. width nicely to provide uniform natural light over the floor area. Artificial light is provided by two-tube fluorescent units hung 12 feet from the floor. They are suspended from brackets that permit movement of several feet either way to give flexibility in case requirements change; the power take-off is from a lighting bus bar. An additional lighting feature is translucent glass in the entire west wall of the building, which keeps out direct sunlight but gives a uniform diffusion of light to supplement that coming through the monitor windows.

In this well-lighted shell are all the necessary equipment, the 33 endless overhead conveyors used to connect one group of machine processes with another, and the assembly conveyors for both the front and rear units.

This long building is divided, roughly, into three sections. All gears are processed and assembled into the differential housing in the north end, and then carried to the south end to be assembled into the rear axle. These units then move, by a platform assembly conveyor, north to about the center of the building, where they meet the front-suspension assembly and the completely assembled front units. At this meeting point is located one end of the 6,634-ft. conveyor that runs to the car-assembly point. This conveyor is loaded in balanced units; that is, one rear-axle assembly is followed by two front-suspension units, and so on.

No Trucks or Skids

Certain basic principles underlie the use of the overhead conveyor units between groups of processes. The cardinal idea, of course, is to avoid the use of trucks and skid boxes between operations. Perhaps this is the most noticeable feature of the whole plan. No boxes are in evidence, no material is on the floor, and trucks are used only to deliver castings and forgings from outside suppliers to first-operation machines—and this happens at only three



Front end and rear axle assemblies meet at the loading point of the 6,634-ft. conveyor that carries them to the final assembly line

points. Deliveries from our own foundry and forge shops are all by overhead conveyors. It is estimated that the elimination of skid boxes and trucking resulted in a saving of fully one-third of the floor space. The conveying means are all overhead, suspended from 14-ft. roof trusses.

Operators never act as conveying means, because conveyors were placed in such a relation to operations that stock loading and unloading is easily done. Loading and unloading points are at working height, to avoid heavy lifting. Disconnected operations are not interfered with, nor are workers required to dodge parts suspended from moving conveyors. Heavy mesh wire netting is placed under the travel of all group conveyors, except at stock handling points, where the elevation is dropped to working level.

The application of process chart technique to the study of process layout resulted in raising several questions. One of them was, "can any operations be combined?" Because we were dealing with a new layout, not the revision of an old one, this possibility was not neglected. For instance, at the end of a group of operations, inspection is necessary. The part is then hooked on to another conveyor to be taken to a group of machines for further processing. The inspector has to remove the part to do his job, and when he has finished, he hangs the part on the group conveyor to the next process. Thus a special transfer operation is avoided.

Endless Conveyors

For example, the differential carrier comes to an inspector's bench after the machining operations are completed. A group, or unit, endless conveyor runs between the finished machining point and the inspector's bench. A second endless conveyor connects the inspection bench with the differential carrier assembly point. The inspector takes the part from the first conveyor and replaces it on the second. This pattern is repeated every time a parts inspection is made.

This same unit may serve as a further example of the guiding principles upon which the installation was made. The inspector's bench is 15 feet away from the differential carrier assembly point, yet the conveyor connecting these two points is 600 feet in length. It runs from the inspection bench east to the opposite side of the building, takes two loops through four bays—four lengths of conveyor—and returns to the assembly point on the west side of the building.

In other words, this conveyor and all the 33 endless conveyors in the building are doing dual jobs. They are a means of getting parts from one operation to another; at the same time, they serve to maintain a bank between two succeeding operations—a storeroom, but a storeroom on wheels, with every unit immediately accessible and always available at working level at the point of use.

It might be asked why this moving storeroom is needed between operations. It must be understood, of course, that such provision is not made between every two machines or operations. In cutting teeth on the ring gear, for example, a battery of roughing cutters is required. The quantity in the bank

from the facing operations to these gear cutters is all on one conveyor serving all the cutters—not between any two of these machines. But a bank, which determines the length of the group conveyor, is provided between the battery of rounding gear cutters and the battery of finishing cutters.

Uninterrupted Production

Next to keeping material off the floor, the float service performed by the conveyors is, perhaps, the most outstanding feature of the installation. The purpose is, of course, to provide for continuous, uninterrupted production. Any one bank of machines performing a particular operation could be down for several hours, and yet succeeding operations would not be stopped. It is only on assembly conveyors, where completed units are put together on a moving platform, that no provision is made for these moving storerooms between operations. We have this type, of course, for the assembly of the rear axle and front suspension units, but in processing the individual parts that go into these units, a float conveyor is introduced between process groups, as exemplified by the differential carrier just described.

A more spectacular float service takes place between the foundry and the axle plant, in the case of brake drums. The foundry operates on an 8-hr. shift; the axle plant runs 21 hours each day. It is necessary, therefore, to accumulate enough castings in 8 hours to last the axle plant 21 hours. A traditional solution would be to store them in large boxes and move them to the point of use as needed. Our solution, however, was to hang the necessary accumulation on an overhead conveyor. There are only two moves—one, to hang the drum on the conveyor at the inspection point in the foundry; the other, to take it off at the first machining operation in the axle plant. If I may drop into the lingo of the motion study expert for a moment, we have almost entirely eliminated the "get-ready," and, remembering the interconnecting unit conveyors exemplified by the differential carrier, the "put away" as well—at least this is true as far as materials supply and removal are concerned.

Perhaps it should be stated that the size of the float between groups of processes was determined by operating supervision. It was then an engineering problem to determine the length of each unit conveyor, according to the hook spacing on the chain, which was dictated by the dimensions of the part to be handled; and to decide where the conveyor loops carrying the float were to be placed. This same problem arose, of course, at the end of each process group and at the start of the next.

Process groups have been mentioned several times; more elaboration will illustrate how unit conveyors serve as connecting links. Almost any one of these connecting points might be used as an example, but the ring gear blank facing and gear cutting operations will serve, since they have already been mentioned.

At the final facing operation, the machine operator hangs the blank on a hook of an overhead conveyor, which dips at this point to convenient working level. This 880-ft. conveyor, carrying a float, passes over an aisle and runs over two parallel rows of gear cutters. Travel is continuous, and float loops are up overhead, out of the way. The gear cutter operator loads his machine from the continuous supply of blanks passing by immediately adjacent to the loading point. When a blank is completed, the operator hangs it on another conveyor, which also runs over one of the rows of cutters, and the part runs through an automatic washer before going to the inspector's bench. In the meantime, the gear cutter has been loaded from the continuous supply coming from the facing processes. In this loading and unloading operation, the operator has moved about 4 feet, and no material has touched the floor.

At the inspector's bench, one of the previously mentioned transfers is made—the inspector hangs the blank on another unit conveyor which accumulates these gears, and the pinions as well, and takes them into the heat-treat department adjacent to the inspection benches. The green gear conveyor, one end of which runs into the heat-treat room, is 1,260 feet in length, and again is a moving storeroom, serving to hold the float of ring and pinion gears between these two points. If heat-treat is not ready to handle the part at one passage, it may have better luck the next time around.

No lost motion at the inspector's bench. Parts taken off one conveyor are inspected and placed on another that takes them to next operation. Boxes are for salvage

Operators Scarcely Move

The pinions follow just about the same pattern as the ring gears, as far as conveyor servicing is concerned. From the turning and facing operations, they are hung on a conveyor running over the gear cutters. Between the two rows of cutters, a second unit conveyor takes the rough-cut pinions to a battery of finish cutters; a third unit conveyor goes through the washer—the operator making the transfer—then to the inspector's bench, and on to the green gear conveyor to heat-treat—the inspector in this case making the transfer from one conveyor to the other. For no step in this whole process does the individual operator move more than 3 or 4 feet, and the shift from one unit conveyor to another is a part of a process or an inspect—it is not an additional operation.

(Continued on page 172)

Not one of us humans but hankers for Supreme Tests, Big Moments. War, catastrophe — every crisis unlooses within us huge amounts of the "emotional dynamite" that spurs us on to do the impossible. Thus the war emergency may well be management's Big Moment—its heaven-sent opportunity to apply out-of-the-ordinary efforts to some of its everyday objectives

Management's Big Moment

"WE ARE IN DANGER!" With these four words Winston Churchill, after the retreat from Dunkerque, brought to Britain more unity than it had ever known.

In similar fashion our own Defense Emergency may serve, God willing, to bring back to us here much of that common understanding and willing teamwork which unfortunately was so generally destroyed by the long years of the depression.

Every crisis unlooses within us humans an unbelievable quantity of latent dynamite—emotional dynamite. Drunk or sober, young or old, we all delight to unloose this inner explosive and with it *do the impossible.* All that is needed is that the explosion appear required to get us out of a vital, crucial jam. Not one of us but hankers for Supreme Tests, for Big Moments. They give us a glorious feeling of inner and hitherto unsuspected powers—a chance to feel surer of ourselves, our nobility, and our adequacy. If this weren't true, we'd never have to listen to all those who "want to tell you about my operation." If it weren't true, those who live the dullest lives wouldn't buy and read the most "Westerns" and "True Love Confessions"—and kids and drunks would stop turning in their super-quota of phony fire alarms.

It is because this emotional dynamite is always freed in Great Crises that a few years of national emergency are seen to change a whole people's behavior, ideas, and ideals more than a whole generation of easy-going humdrum. Without the fears—without the Big Scare—of '31-'36, we should never have dreamed of so completely losing our faith in ourselves while we put it in our government. And without that same Big Scare we should hardly have seen the depression's evil brood of class hatreds and class conflicts.

That brood, I am convinced, represents the same effort to bolster self-confidence that I have often observed among my fellow 'boes' and bums.

Fully conscious of their failure, hoboes begin by blaming it on somebody other than themselves—"the goddam bankers" or "the blood-sucking industrialists and their job-destroying machines." Next they claim that their desire for "nothin' but somethin' to eat and drink and a place to sleep" demonstrates their personal simplicity, wholesomeness, and all-round virtue! From there they find it easy to prove that they are the "smart guys," the rest of us "greedy but soft-headed saps."

In the same way and for the same reason, jobless, defeated, jittery America in the thirties proceeded to save its face first by blaming the depression on the business-industrialist and his wicked willingness to take risk. Next it extolled the humble joys of Security and the evils and impossibilities of Opportunity. Finally, because the depression appeared to foretell an everlasting shortage of jobs and therefore a permanent denial of work's self-respect and self-justification, the country thrilled to the gospel of Humanitarianism—a gospel that proclaimed abundance and salvation via a virtuous shift away from individual effort and wealth production to collective leisure and wealth-sharing, away from work-a-day cooperation to the gratifying thrills of class enmity and conflict.

London: Morning After *Wide World*

WHITING WILLIAMS
Consulting Editor

All very gratifying to the soul if not very filling for the stomach—until one Adolph Hitler proceeded to displace the Big Scare behind it all with a still bigger one!

Thanks to him we now have more jobs than men! Thanks to him, we can now save our skins only if we can *do the impossible*—do it *at once*—do it under the leadership, believe it or not, of those experts of organized effort known as Industrialists!

As a result, the factory manager is in position to help us save ourselves and our country. To do this he need remember only one thing—*we humans delight to follow the line, not of least resistance, but of maximum recognition and self-justification per unit of effort.* If only we can enjoy the thrill of mastering a Big Emergency, we are overjoyed to do—and see done—things we'd abhor doing or favoring under ordinary conditions.

Our own and the world's present crisis thus offers the manager precious opportunity for out-of-the-ordinary efforts to accomplish such everyday objectives as the four that follow:

1. Improve his managerial organization. He can make now those long-needed but long-delayed (because so often delicate and ticklish) promotions, transfers, demotions, and (now that jobs are plentiful) discharges.

He can now bring his foremen, skilled workers, and clerks back into the relative ratings and importances from which too many of them have been pushed by the recent years of rank-and-file super-pressure. He is now justified in fresh experiment with incentives, job analysis, work simplification, training and study plans, merit ratings, tests, the plant paper, etc.

2. Take a fresh look at all his employee contacts, to make sure that his every representative enables every single employee to *share the "kick"* of helping toward the common objective of saving the country.

This can include a check on the impression made by the gateman, the paymaster's clerks—all those who daily touch *all* employees.

The Emergency now makes proper—indeed the government now urges—the *mass meeting* for explaining the company's part (even if indirect) in the common defense. Toward the same end of *sharing with all* the thrill of the common danger and the common objective, management can now arrange a *celebration* for the opening of new defense buildings, the installation of new defense equipment.

Open houses for employee families may perhaps be prohibited by the defense rush. But some companies are spreading the satisfactions of industry's Big Moment by inviting employee wives to use company rooms for sewing materials supplied without cost by the local Red Cross or Bundles for Britain.

Above all, every chief executive will do well to remember, now, that "an hour a day keeps trouble away"—if he spends the hour chatting with workers in different parts of the plant.

In all this he will do well to guard, as overtime increases, against that other variety of emotional explosive known as "TNT"—tiredness 'n' temper.

3. In short, as rapidly as the emergency intensifies—and it is now pretty sure to intensify rapidly—the wise manager will not fail to assume that his associates, like the British, would "rather die on our feet than live on our knees"—and so to ask of all *their utmost.*

This will be given—gladly as now in Britain and Greece—provided only that, when given, the givers fail not to receive due acknowledgment and recognition. ("Never," thus Churchill rewarded the glorious RAF, "never in the field of human conflict was so much owed by so many to so few.")

4. It is not too early to plan now, just how the emergency's emotions can be directed into constructive channels as soon as the present crisis is met and mastered.

For it is of the nature of this emotional dynamite that it never goes stale and dead the moment the Big Emergency is passed. On the contrary, its potential power subsides slowly and, while subsiding, seeks other outlet. Thus in Italy, the soldiers who returned still "het up" from World War I, first took the outlet provided by the local reds in the industrial north. Later they utilized the channel provided by one Mussolini. Similarly in Germany, the republic, by failing to provide an outlet designed to restore its standing among the nations, served both to "page" Hitler and also to hand over to him a wealth of emotional high explosive with which to attain his end.

"We are in danger!"

Unless all signs fail, the meaning, the power, and the glory of these same words will daily grow greater for us here. The full heeding of that meaning and the full utilization of that power and glory represent something more than a mere selfish opportunity for the industrial manager. Instead, they represent a duty on behalf of all his fellow-citizens. Failure to fulfill that duty will endanger his country by depriving it of its undreamed-of resources of physical and spiritual power. In addition, such failure will deprive his country's people of the glory and the thrill of meeting their Big Test—and best of all, of meeting it *together.*

Control—With Two Pieces of Paper

Thousands of items. Hundreds of orders in the shop at all times. Yet a visible record system with two forms supplies all data needed for close control of production

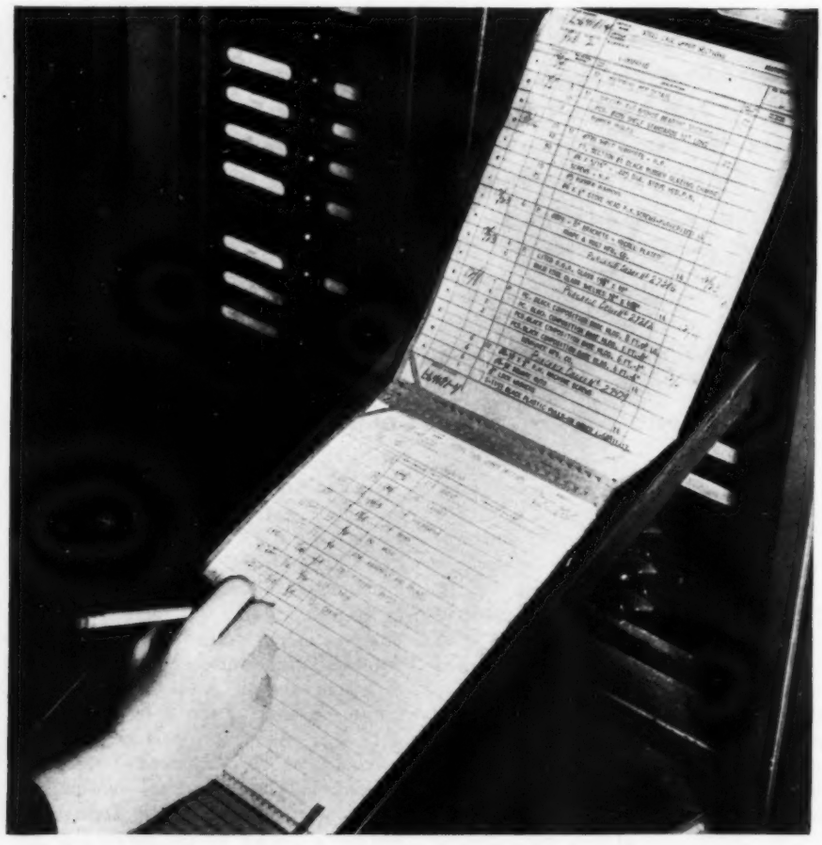
S. R. TERANES
Industrial Engineer, Hamilton Manufacturing Company
Two Rivers, Wis.

KEEPING AN ACCURATE RECORD of the progress of each order and knowing whether incoming materials have been received when needed, would appear to be a very complicated process in a large plant like ours, which manufactures thousands of items and has hundreds of orders in process at all times. Actually, modern equipment and methods have provided a simple and effective solution.

After the engineering department has completed the necessary drawings and material lists, Figure 1, the order is routed for production. The various departments through which the order must flow are listed on a production order, Figure 2. The original copies are written in longhand, sent to the standards department for the application of time standards, and from there to the typist who uses an electric hectograph typewriter.

From these typewritten copies, which are the master copies of the production order and material lists, all necessary paperwork for the shop is run off. Before shop copies are run off, the typed master copies are sent to the schedule clerk for production schedules. The schedule clerk must analyze each order, note what purchased items are on the material list, and know what department is concerned and when it will need these items. To enable the schedule clerk to schedule orders intelligently, departmental load charts are maintained in the production department.

After schedules have been worked out for delivery of purchases and completion dates for production departments, the master copies of the production order and material list are sent to the duplicating machine where copies are made for each production department, plant dispatchers, and order progress record file. The file used is of the visible record type with 8½x11 pockets, each designed to hold copies of the material list and production order.



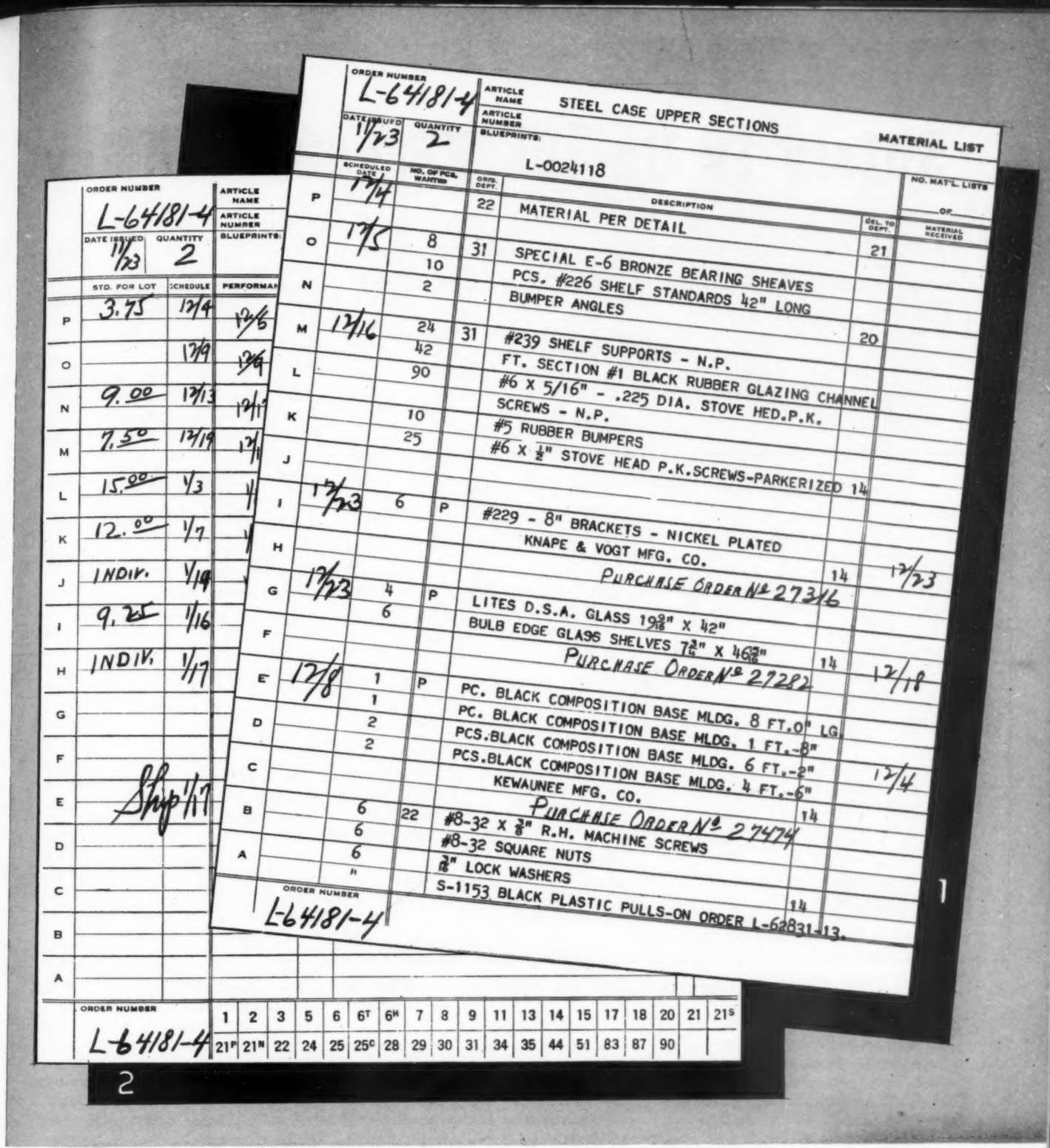
Master copies of orders are placed in a visible record file. The material list and production order face each other, so that complete information is available at a glance

All Information at Hand

Upon receipt of the copies of the production order and material list, the order progress clerk files these consecutive orders, slipping the material list into the back of the pocket of the preceding order and the production order into the front of the next pocket. All information about the order is thus at hand—materials purchase, materials requisitioned from storerooms, routing schedules, etc.

To facilitate the checking of delays on an order, a colored signal system is used. The bottom of the file pocket has an insert on which numbers from 1 to 31 are printed. The scheduled receiving dates for purchases and completion dates for production departments are signaled by inserting celluloid tabs on the due dates. Several colors are used, a certain color being designated for each month. The due or completion dates are signaled in consecutive order.

For example, the first due date on the order shown in Figure 2 is *12/4* for *Dept. 21S.* The next is purchased items on material list due on *12/8.* The signal is moved from *4* to *8* to show that that is the next item to fall due and must be brought to attention on the eighth of the month. When a tray of orders is checked, the color scheme enables one to spot delays immediately, because any signal tab back of the current date will show that the order is behind schedule. The use of different colored tabs for each month prevents difficulties in interpreta-


ORDER NUMBER L-64181-4
ARTICLE NAME STEEL CASE UPPER SECTIONS
ARTICLE NUMBER
BLUEPRINTS: L-0024118
DATE ISSUED 11/23
QUANTITY 2
MATERIAL LIST
SCHEDULED DATE
NO. OF PCS. WANTED
ORIG. DEPT.
DESCRIPTION
DEL. TO DEPT.
NO. MAT'L. LISTS
MATERIAL RECEIVED
P 12/4 22 MATERIAL PER DETAIL 21
O 12/5 8 31 SPECIAL E-6 BRONZE BEARING SHEAVES
10 PCS. #226 SHELF STANDARDS 42" LONG
N 2 BUMPER ANGLES
M 12/16 24 31 #239 SHELF SUPPORTS - N.P. 20
42 FT. SECTION #1 BLACK RUBBER GLAZING CHANNEL
L 90 #6 X 5/16" - .225 DIA. STOVE HED.P.K.
K 10 SCREWS - N.P.
25 #5 RUBBER BUMPERS
J #6 X 1/2" STOVE HEAD P.K.SCREWS-PARKERIZED 14
I 12/23 6 P #229 - 8" BRACKETS - NICKEL PLATED
H KNAPE & VOGT MFG. CO. 14 12/23
PURCHASE ORDER Nº 27316
G 12/23 4 P LITES D.S.A. GLASS 19 3/16" X 42"
6 BULB EDGE GLASS SHELVES 7 3/16" X 46 3/16"
F PURCHASE ORDER Nº 27282 14 12/18
E 12/8 1 P PC. BLACK COMPOSITION BASE MLDG. 8 FT.0" LG.
1 PC. BLACK COMPOSITION BASE MLDG. 1 FT.-8"
D 2 PCS.BLACK COMPOSITION BASE MLDG. 6 FT.-2" 12/4
2 PCS.BLACK COMPOSITION BASE MLDG. 4 FT.-6"
C KEWAUNEE MFG. CO. 14
B 6 22 PURCHASE ORDER Nº 27474
6 #8-32 X 3/8" R.H. MACHINE SCREWS
A 6 #8-32 SQUARE NUTS
" 3/8" LOCK WASHERS
ORDER NUMBER L-64181-4 S-1153 BLACK PLASTIC PULLS-ON ORDER L-62831-13. 14
1
ORDER NUMBER L-64181-4
ARTICLE NAME
ARTICLE NUMBER
BLUEPRINTS:
DATE ISSUED 11/23
QUANTITY 2
STD. FOR LOT
SCHEDULE
PERFORMAN
P 3.75 12/4 12/6
O 12/9 12/9
N 9.00 12/13 12/11
M 7.50 12/19 12/1
L 15.00 1/3 1/
K 12.00 1/7 1/
J INDIV. 1/14
I 9.25 1/16
H INDIV. 1/17
G
F
E Ship 1/17
D
C
B
A
ORDER NUMBER L-64181-4
1 2 3 5 6 6T 6H 7 8 9 11 13 14 15 17 18 20 21 21S
21P 21N 22 24 25 25C 28 29 30 31 34 35 44 51 83 87 90
2

The material list, Figure 1, shows all materials needed for an order, where they will come from, and when and where they are to be delivered. The production order, Figure 2, shows the departments through which the order must flow, and the date it is due

tion which might occur, especially at the beginning or the end of any month.

To follow up purchased items on orders in the order progress file, the file clerk receives a duplicate copy of the purchase orders. Only copies of purchase orders that apply are received. Purchases made to replenish stock items are not received. Upon receipt of the duplicate copy of the purchase order, the file clerk enters the purchase order number on the material list. The purchase order is then filed in consecutive order for future follow-up with the purchasing department if materials do not arrive as scheduled.

The receiving clerk sends copies of his receiving report to the order progress clerk daily. Dates are posted on the material list in the "material received" column.

If materials are not received on or before the date scheduled, the file clerk removes the duplicate copy of the purchase order from the files, stamps across it "materials not received" and sends the sheet to the purchasing department for follow-up. The purchasing department immediately gets in touch with the vendor to find out when shipment will be made. If the vendor

(Continued on page 176)

Safety Is Up the Foreman's Alley

So General Motors tosses the job into the supervisor's lap, makes it his opportunity as well as responsibility

M. J. McCARTHY
Safety Director, Fisher Body Division
General Motors Corporation, Detroit

SAFETY SUGGESTION NO. 115

A toolmaker was grinding a small piece of stock on a disc grinder. His hand slipped and struck the wheel and he got a severe emery burn on his finger.

CAUTION: Use extra care while working at any type of grinder and be sure you have a secure grip on the stock which you are grinding.

****

A layout man was ripping a piece of stock on a mitre saw, the saw wedged into the stock and before stopping machine, he attempted to lift the stock off the table. The stock kicked back and the saw amputated three of his fingers.

CAUTION: When working on a machine and anything unusual happens to the feed or material STOP THE MACHINE FIRST then make your adjustments after.

****

Elevator operator opened a manual controlled swing door to allow an electric truck off the elevator. He had opened one side and while opening the other side, the truck driver, who was in conversation with a third party, made a sharp turn and ran over the elevator operator's foot and knocked him to floor. The injured

Figure 1. The safety director suggests topics for weekly meetings held by the foremen

THE IDEAL SAFETY CONDITION is a plant with no accidents. But this ideal cannot even be approached unless all hazards are fully guarded; unless workers are safety conscious in their every act; and unless supervision is imbued with the idea that leadership in safety is as important as leadership in production.

Our plants are safe; in fact, our employees are far more likely to have accidents in their free time than they are during working hours. In the first three months of 1929, lost-time accidents in the corporation totaled 658; in the same three months of 1939 the total was 31. This record was made with 29 plants working close to 5,000,000 man-hours per month. Ten of the 29 are fabricating plants, in which some of the most hazardous operations in industry, such as press work, are carried on. Carelessness, unsafe work habits, and failure of supervision to provide effective leadership are frequently stated as the major causes of accidents. The record of reduction in lost-time accidents in our company could not have been made, had we not been successful in eliminating these causes to a great extent.

The program consists in fresh thinking about the safety problem; in making it a responsibility of supervision of equal or greater importance than output at a reasonable cost; and in educating supervision to safety as an opportunity as well as a responsibility. The problem is placed in the lap of supervision, where it belongs, and staff assistance is provided if and as desired by operating officials of the various units.

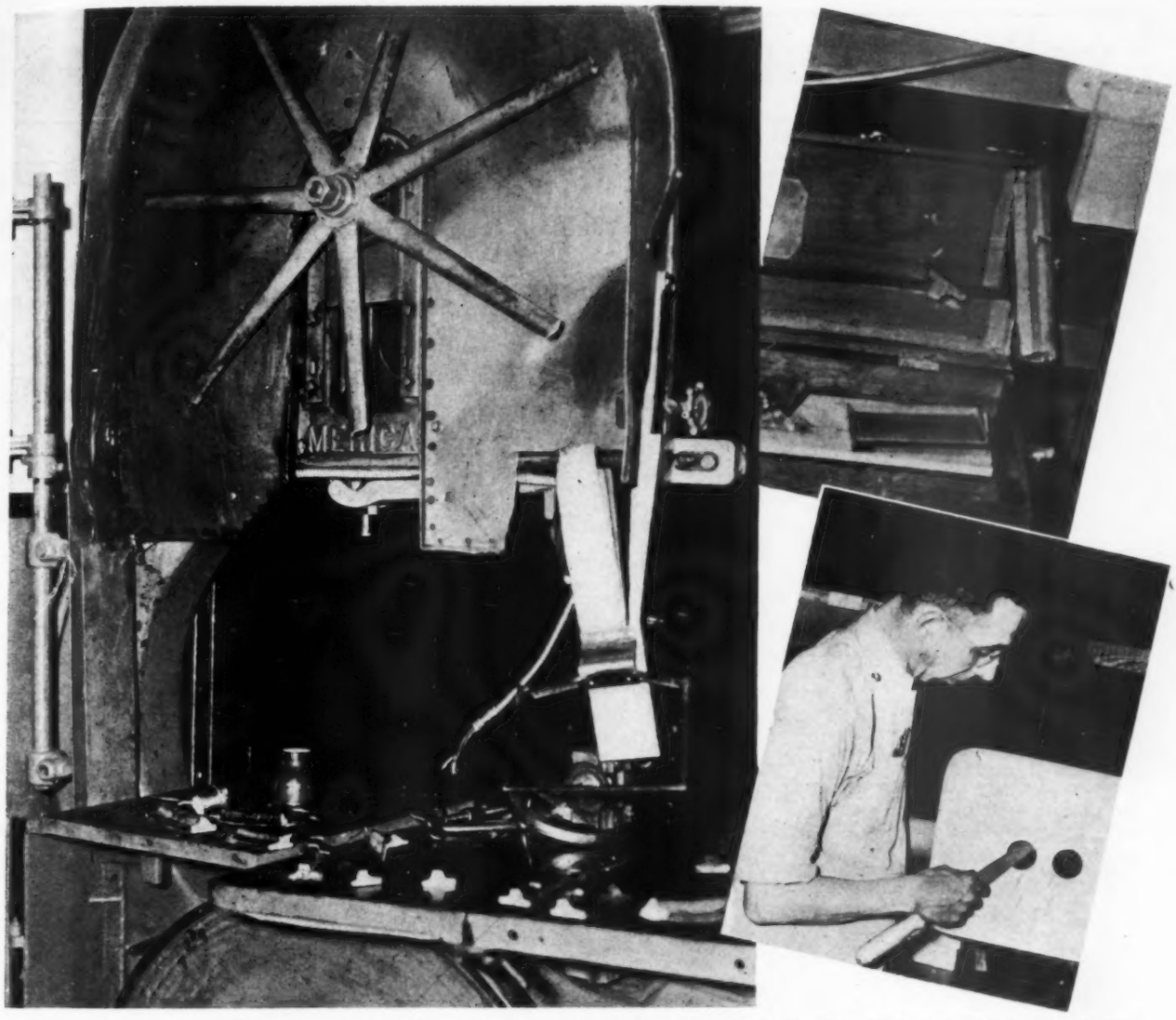
At one time mechanical guarding and the hiring of a safety engineer were considered all that was necessary to make a plant safe. When results in the form of reduced accidents failed to materialize to the degree expected, obviously a different approach was required. No matter how good a safety director may be, after all he is only one person, and he cannot possibly have the same opportunity for intimate and frequent contact with the worker that is open to the foreman.

Changes in Industry

That it is necessary for operating supervision to assume leadership for safety is obvious when we consider the changes that have taken place in industry within the last few years. New workers are now coming into our plants at a later age, and with more years of schooling, than formerly. Moreover, they have had some contact with safety through courses in safety in grade and high school. A supervisor who is not aware of hazards, or who carelessly subjects his workers to them, quickly incurs disrespect and rejection of his leadership.

This new and necessary emphasis is important in another way. As industry is organized today, at least our industry, the major job of a supervisor is organizing the will of his men to work. He is management's contact with the worker. There can be no better meeting ground between the two than matters of safety. If the supervisor is sincere in protecting his workers against hazards, and competent in instructing them in safe working habits, they quickly realize that he is interested in their welfare and accept his leadership more readily.

But it is by no means sufficient to assign responsibility to the foreman and consider the problem solved. His continuing interest is dependent upon the interest, support, and leadership of management above him. Broadly speaking, as much safety will be secured in any plant as the head of that plant wants, or indicates by precept and example that he desires. Imitation is a powerful thing, and especially so in safety education. It is correct to say, then, that if it is important for the foreman to indicate to his men by leadership, education, and example, that safe habits are proper working habits, it is doubly important that top man-



Luckily no one was hurt when this metal band-saw wheel exploded (left). It had been operating at twice its rated speed. Pieces flew as far away as 90 feet. One of them smashed the lid of a tool chest (upper right). The man standing directly in front of the tool chest (lower right) might easily have been hurt. Reports and photographs of accidents like this go to all plant managers, so that they can check similar conditions—in this case, the speeds of rotating machinery—in their own fabricating divisions

agement motivate the foreman in the same way.

Where does the safety director fit into this picture? His function is to supervise safety supervision. Mr. Archer, vice-president of our division, defines him as follows: "A safety director is a jack-of-all-trades with an unholy gift of gab, and the oily persuasiveness of a champagne salesman." Since fully 75 percent of the results of safety education is due to personal contact and selling, this definition fits very well indeed.

Not only in personal contact are such qualifications significant, but they must be manifest in all written communications concerning safety. The foremen in our plants hold 10-minute safety meetings with their men during working hours, when the plant is shut down for this purpose. This is done once a week in six of our ten fabricating plants, in the middle of the morning production period, before thoughts of lunch are apt to interfere. This is a necessary and important part of our safety program. But our experience has been that a foreman, unaided, is likely to run out of material and ideas to keep these meetings interesting and effective. Here is a point at which the safety director can contribute.

For the last two years we have supplied the foremen each week with a safety suggestion, which they may or may not use as they see fit, at their meetings. These suggestions are limited to one page, and must carry the punch that personal contact would give. Figure 1, the 115th suggestion in the series, is typical. The appeal is positive; we keep "don'ts" out of the picture, but explain *what* happened in a particular situation, and *why* it happened, with a caution which should help to avoid such things in the future. Such an appeal is effective. Workers are interested in the "why" of things, but when they are confronted with "don'ts," they are apt to react in the opposite direction from the one intended, as was demonstrated so conclusively during the prohibition era.

Every opportunity is utilized to bring safety to the attention of the worker. Since accidents happen to workers outside our plants to an alarming extent, we cannot feel that safety education ceases at quitting time. Reports of street accidents are available and are used as a means for the supervisor to approach the worker tactfully on the

ANALYSIS OF LOST TIME ACCIDENTS

JUNE, 1939

OCCUPATION	NATURE OF INJURY	CAUSE OF ACCIDENT
Laborer	Amputation of finger tip	Pulling lumber out of transfer track, gears slipped causing a kick in control lever catching fingers between lever and release clip. 100 days.
Apprentice in Tool & Die Dept.	Hernia	Employe was carrying an 85 pound die section from the bench to the assembled die. Caught foot on air hose and stumbled, but did not fall. 56 days.
Electric Truck Driver	Hernia	While loading truck, employe stepped upon a piece of rubber hose which was allowed to be left lying on the floor. Hose rolled, employe lost balance and twisted his side. 56 days.
Metal Finisher	Hernia	Fellow workman pushed a body truck approximately two feet striking employe in the groin. Employe continued working, sometime later hernia developed. 56 days.
Duco Sprayer	Hernia	Floor was covered with wet paint and when

Figure 2. A monthly analysis of lost-time accidents, showing nature of injury and cause of accident, is sent to all managers

question of safety. They are decidedly not used as a whip; such a use would lead to resentment and hence lose whatever value they might have.

We are all interested in safety from a humanitarian standpoint, but there is an economic angle that must also be recognized. If our workers are injured away from the plant, their productive capacity is just as effectively lost as if the accident happened in the plant. In either case a new, and perhaps unskilled, worker must be substituted. In these weekly safety meetings, consequently, the foremen discuss safety pertinent to the time of year. In the hunting season the safe way to handle a gun; in winter, the matter of safe driving on icy streets; and frequently the subject, "safety in the home," is used as a topic. We do not want our workers to forget what they are taught in the plant as soon as they clear the plant gates at night.

Meetings Are Important

These meetings form an important means of reaching the worker, and much of our success in keeping our plants safe is due to the effective use that supervision has made of these meetings. It should not be assumed, however, that this device is open only to the large company with many plants; it is equally available to a single plant, either large or small.

At one period in safety thinking it was assumed that rigid rules could be established, and firing could be relied upon to maintain them—"don'ts," if you please, in rather large doses. But this has gone the way of many other ideas which sought to legislate people's thinking. Leadership, education, and example have taken their places in the safety movement. I mentioned before that the effectiveness of the safety movement in any plant is dependent upon the desires of the operating head. It is a temptation, perhaps, to draw up elaborate instructions as to how this or that should be done. This, however, results all too frequently in a mark to shoot at, an opportunity to make it fail.

Means must be found to make safety a habit throughout the organization. In a small plant the departments may be ranked monthly by their safety record. In our company this monthly ranking is done by plants as units, and serves to acquaint plant managers with the effectiveness of measures which they individually sponsor. Of course, an executive responsible for operating a plant is concerned with many things; safety, however important it may be, is only one of them. As an aid to him, all lost-time accidents in the corporation are analyzed monthly (Figure 2). This analysis, which is sent to all plant managers, includes *why* the accident happened, and affords the managers an opportunity to confer with their assistants about the likelihood of such conditions existing in their own plants.

We go further than this. Some failures of equipment may not result in injuries, but the reason for such failure may be due to faulty operation which might very well have caused an accident. An example is indicated in the picture of the exploded band-saw wheel. Upon investigation it was found that the machine was being operated at 1,200 r.p.m. when the speed should have been 600 r.p.m. Pictures were taken and sent to all plant managers, offering a good object lesson of the importance of checking the r.p.m. on all rotating machinery.

Bulletin Boards Useful

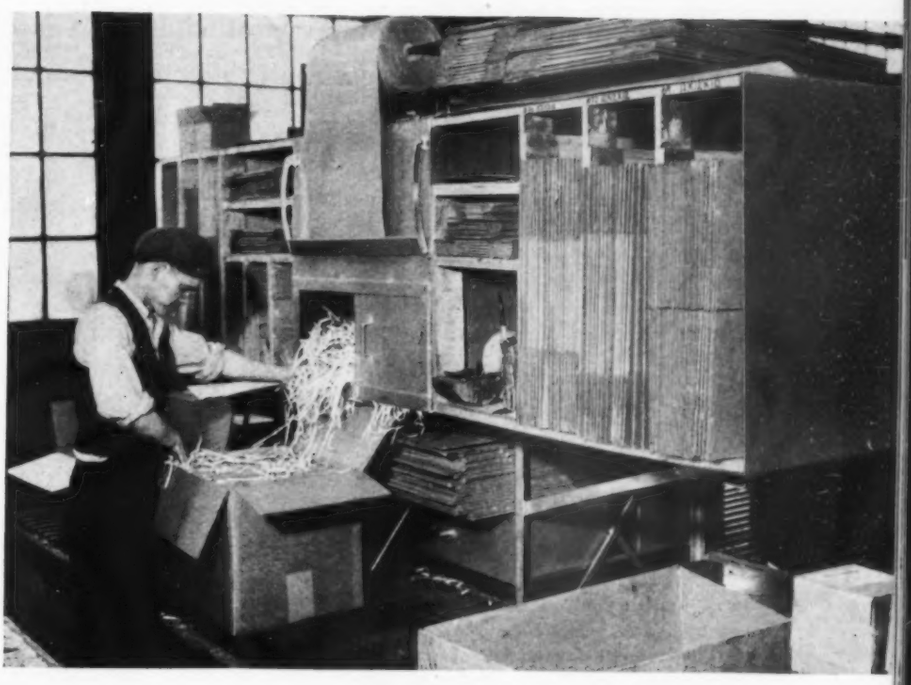
So far I have mentioned foreman safety meetings, monthly safety ranking of plants, and analysis of causes of accidents as means of inculcating safe habits. There are others, of course. Bulletin boards are utilized in conspicuous places in our plants. On them are displayed posters supplied both by the National Safety Council and by our own efforts. Gruesome details are not stressed, because we believe it more effective to appeal positively to the intellect rather than negatively through fear.

Neon signs are placed in each operating department of our fabricating

(*Continued on page 178*)

Packing: the Motion Economy Way

How the familiar principles of work simplification may be applied to packing operations at little cost, with much profit. These three examples are out of Westinghouse experience



EVERYTHING WITHIN REACH. Cartons all the way from 6x6x6 to 23x23x15 inches in bins. Paper roll in front. Gluepot and gummed paper tape to right of shredded paper bin. Cartons move on roller conveyor to scale, then to shipping floor. Parts to be packed, on bench behind.

SHE WORKS MORE EFFICIENTLY and with less waste motion because parcel post packaging materials are properly arranged. Cartons are on the top shelf, but within easy reach. Shredded paper in the bin at the left. Conveyor leads to spiral chute which discharges into the parcel room.

PARTS TO BE COUNTED and put into cartons are delivered in pans on a roller conveyor. Pans are tilted to empty their contents into round-bottom bins. Packer puts carton in front of bin, rolls or pulls the parts into it. Shredded paper, gummed tape, and paper roll are all within reach.

Supervisors Come Home to Learn

Whereby Armstrong Cork improves mutual relationships throughout the company. Each supervisor meets company officials, learns about external and internal problems. He goes back to his own job reflecting the corporate personality of the company

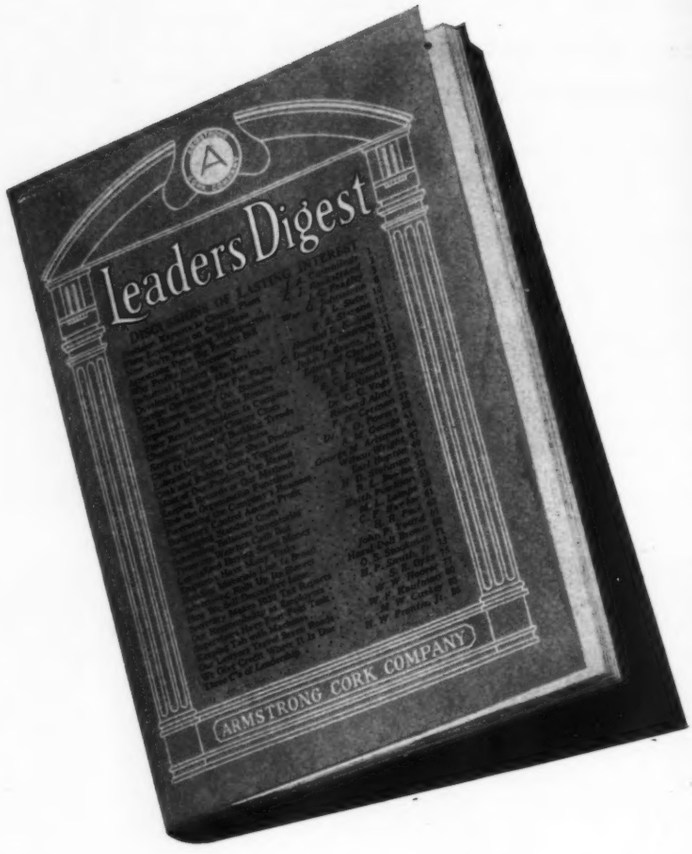
DURING THE PAST THREE YEARS, more than 530 Armstrong men—superintendents, engineers, chemists, foremen, office supervisors—have visited the home office of the company in Lancaster, Pa. From California, Massachusetts, Florida, and any other state in which the additional 17 domestic operations of the company are located, these men traveled to spend a week in getting acquainted with Armstrong officials and employees, and in studying and discussing problems and policies with company directors and executive officers, technicians, and department heads.

This Home Office Week program was inaugurated in 1938 by H. W. Prentis, Jr., Armstrong president, and the personnel department, to provide production supervisors with a complete understanding of every condition faced by the company from without or within. It was believed that this knowledge could be passed on to every employee, with improvement in labor and public relations, and better manufacturing results.

Return Visit

The success of this Armstrong plan for dealing with a general supervisory training program in a personalized manner is attested by the fact that the original contingent of visiting supervisors returns this spring for their second Home Office Week. This time, however, no period of orientation will be necessary; these Armstrong men from various factories already know the home-office executives. During the week they will discuss such vital subjects as national defense, cooperative management, unemployment, future sales, legislation, industrial management, finances, and a wide field of related problems.

When the week's session is ended, these supervisors will return to their positions, mentally stimulated, and with a thorough understanding of current Armstrong policies and problems. Not only has their knowledge of the entire business been greatly increased, but they have also received an understanding of company policies and principles of operation that will assist them materially in their relations with the men under their supervision.



A digest of the talks made by Armstrong executives during Home Office Week. In a foreword, the "Leaders Digest" thanks the editors of "Reader's Digest" for their permission to use the format of their "highly interesting and widely read publication"

Of additional importance is the fact that all employees are kept continually well informed about general conditions within their company; many of the supervisors return to their plants and review the entire Home Office Week program with their respective groups.

Under the present program, each field supervisor returns to Lancaster for a visit every three years. The visiting group is small enough so that each supervisor is given the opportunity to express his opinions on various subjects. The entire program is arranged in detail by the personnel department, under the direction of Personnel Manager John J. Evans, Jr.

When he arrives in Lancaster each supervisor is presented with a notebook outlining the week's activities, with his name imprinted upon the front cover. During the week, the men are housed at Armstrong Manor, a large country home owned by the company. In that atmosphere—not unlike that of a college fraternity—they have an opportunity to further friendships, to compare notes, and to discuss various phases of the company's activities. At the end of the week, an evening is

A group of factory assistant superintendents arriving at Armstrong Manor to begin their week of study at the home office. They look very happy about the whole thing

devoted to recreation and good fellowship, following a dinner at a club in Lancaster. When these men return to their regular jobs, they reflect the corporate personality of the Armstrong Cork Company.

A broad and comprehensive program is arranged for each week. Every production foreman, for example, not only enters into production discussions with home-office officials, but he hears talks also on sales, advertising, scheduling, purchasing, new products, earnings, and taxes. This year motion pictures and slides are being used to emphasize important problems.

Perhaps one of the outstanding reasons for the success of the program is that top-ranking executives of the home office take an interested part in the activities of each visiting group. For example, during the 29 weeks of the 1939 program, Mr. Prentis, president, delivered 28 of the final talks of the week. His only absence was occasioned by a severe cold. The first vice-president, F. L. Suter, is equally assiduous in meeting with each group. Divisional vice-presidents deliver informal, informative talks relating to their individual fields. Each group of supervisors is encouraged to ask questions, so that every session takes on the aspect of a round-table discussion.

As with all intangibles, exact measurement of the value of Home Office Week is difficult. Judging from the comments of many supervisors, and other employees who share indirectly in the programs by discussions with their supervisors, these programs are playing a definite and important part in improving the morale of Armstrong's 9,700 workers in the United States. Supervisors feel that, together with the broad general program followed by the personnel department for improving employee relations, the increased knowledge imparted to wage earners about the policies of the company, through the medium of talks with supervisors who have attended the sessions in Lancaster, is of considerable importance.

"A Member of the Firm"

Indicative of what visiting Armstrong supervisors think of Home Office Week was the observation made by one of them after his first visit:

"I was made to feel as though I were a member of the firm and that I should work for the interest of my own company."

In the extent that each supervisor can impart that feeling to the wage earners whom he directs, lies the answer to the question of how effective this Armstrong method of promoting better mutual relationships will become. Company executives themselves are certain that the program is of increasing importance; that is the reason the second 3-year phase of Home Office Week is anticipated with increasing interest and enthusiasm by everyone in the organization.

Learn to Talk-and Like It

A group of employees got together and organized a public-speaking class. They're learning a lot and having good fun at the same time

JAMES ERWIN
General Electric Company, Philadelphia

EARLY IN THE FALL of 1939 I conceived the idea of a cooperative public-speaking class, and happened to mention it to a few of my fellow-workers here at the switchgear plant of General Electric Company in Philadelphia. To my surprise the idea received enthusiastic response.

Our original plan was for a weekly meeting to be held in one of the conference rooms at the plant. In this plan the management cooperated to the fullest. The class was to be composed of the 12 of us who had agreed to hold the sessions, but the group soon grew to 16, and would have continued growing had we not set a limit to the number. The reason for the limitation was to govern the length of time consumed in each session. We had chosen to make the sessions one hour in length so that, beginning at 5:05 p.m., we could finish the last of the speeches by 6:05, and be home in time for dinner. In so arranging the time and length of the sessions there would be no lurking fear of family trouble, and no feeling of personal deprivation through interference with plans for the evening. By this means we could all come to class free from any worry, and be assured that we had everything to gain and absolutely nothing to lose by attending.

(Continued on page 180)

Much Less To-Do, Much More DO

JAMES J. BAER

Industrial Engineer, Rubberset Company, Newark

IT WAS NOT EVER THUS in the orderly department pictured at the top of the page. It's our brushmaking department where seventy girls are today making 25 to 30 percent more brushes than they used to—with much less expenditure of effort and with resultant bulges in their weekly pay envelopes.

Their job is to weigh out the right amount of bristle and then insert it into the metal ferrule to which the wooden handle is later assembled to make the completed brush.

Time was—before work simplification—when each girl arranged her workplace to suit her fancy and made her brushes in her own sweet way. She had to fetch her own trays of bristle and ferrules from stock. She had to make up her own sample brush and get the weight okayed by the foreman before she could go ahead with the job. She had to cart away her trays of finished work. Not that it was such hard work. Bristle doesn't weigh up heavy. A box of ferrules is a light load. But it all meant an undue amount of hopping up and rushing around, with a good bit of needless delay and a considerable degree of congestion. The department was literally jammed to the doors with work. Aisles were cluttered up with stock trays. Girls dashed about looking for the foreman or hunting for a gage. There was much too much *to-do* and far too little *do*.

Today each girl spends practically 100 percent of her time in productive effort. She's a brushmaker, not a rustler of raw materials or a hustler of finished work. She sits. Her work is brought to her. No longer does she make up her own sample brush and then waste precious minutes getting the foreman to check the weight. The sample is now made up by a sample maker and delivered to her with the order; she uses it as a counterweight on her scale so she can't go wrong. And no longer does she have to take time out and dig the right gage out of the box of gages in the stock section; it comes to her with the work.

Aisles—look at the aisle in the photograph—are clear. No boxes of bristle. No trays of brushes. No girls falling over boxes or trays or, for that matter, one another.

Just seventy girls making brushes. Making more brushes. Making more money. All because it has been made possible for them to make brushes in the "one best" way. Because the application of work-simplification principles—call it plain common sense, if you prefer—has squeezed out the waste of time and motion and effort.

For further details we may with profit examine the close-up view of the brushmaker's workplace on the facing page. Much of the secret—if, indeed, there *is* any secret—lies there.

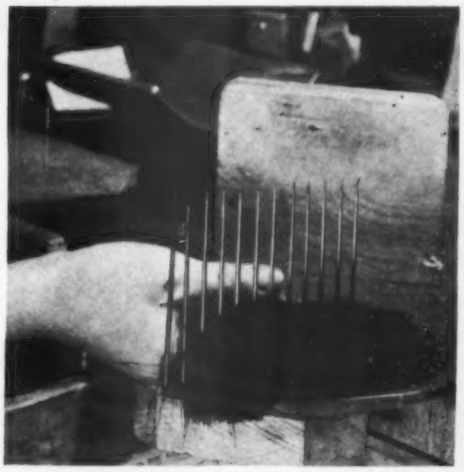
BRUSHMAKER'S WORKPLACE. This brushmaker wastes no time fetching and carrying or hunting up the foreman for an okay. She sits and makes brushes. Sits, be it noted, in a posture chair which hits her in the small of the back where is ought to, and enables her to do a day's work with a minimum of fatigue. Her adjustable footrest doesn't show in the picture, but it's there for her added comfort. Her workbench is plainly constructed with an all-welded frame especially designed to hold work trays. The bench top is of wood faced with composition board which can be readily changed if it becomes rough.

Note that work trays can be slid into compartments under the bench or into the welded framework on top of the bench (at the left). Note also the semaphore pivoted to the top of the framework. When this girl wants the porter to take away a tray of finished brushes, she flips the red and green arm into the "up" position; the yellow and black arm is her signal for more work. Her sample brush comes with the work, as previously stated; here it's on the scale and used as a counterweight. Her old-fashioned balance scale has been replaced by a new one which is more accurate and saves 30 percent of weighing time.

This operator, by the way, is using a brand-new duck cover just developed and not shown in the picture of the department across the page. All she has to do is to slip the cover over a tray of ferrules to convert the tray into a gravity-feed bin. She merely zips the slide fastener as needed to let a few more ferrules roll out on the bench.

Obviously this girl is a brushmaker, not a reacher or a stooper or a fetcher. Who couldn't make more brushes with a workplace like this one?

SNAP GAGE used to regulate length of bristle comes to the brushmaker with the work. She used to go get it, then had to nail it to her bench. Now she slips it over a lug, locks it into working position with a couple of turns of the knurled nut.



BENCH COMB is a necessary tool for the girls who make brushes with long bristles. Old method was to screw on a comb when needed. Now each girl who works betimes on long-bristle brushes has a pre-positioned comb at her workplace. Note wood cover on bench just behind the comb. For safety's sake the comb is covered when not in use.

RATING CHART tells them how they stand. Girls are classified into three groups according to type of brush they make. Each is anxious to improve her standing in her group. After all, her operating effectiveness depends upon her output, and on output depends that pleasant bulge in the pay envelope.

6-Way Plan

ONE THOUSAND WORKERS have recently been placed on the payroll at the 50-acre factory now being built by the Wright Aeronautical Corporation in Cincinnati. This is the first contingent of the 14,000 persons who will probably be employed by this plant when it reaches maximum production.

More than a sufficient number of machine operators to run the high production machines already installed are among the men who are working. Most of them are graduates of the company's vocational training program.

Workers skilled in high precision aircraft engine work were scarce in the Cincinnati area. To meet this situation, the company depended on a training program evolved during the past five years by Bartley Whiteside, supervisor of training, and P. W. Brown, assistant works manager.

A survey was made of the training facilities in the neighborhood. Instructors and machines were sent from Paterson to Ohio, and the entire program was set up to include the following:

1. Company-operated schools.

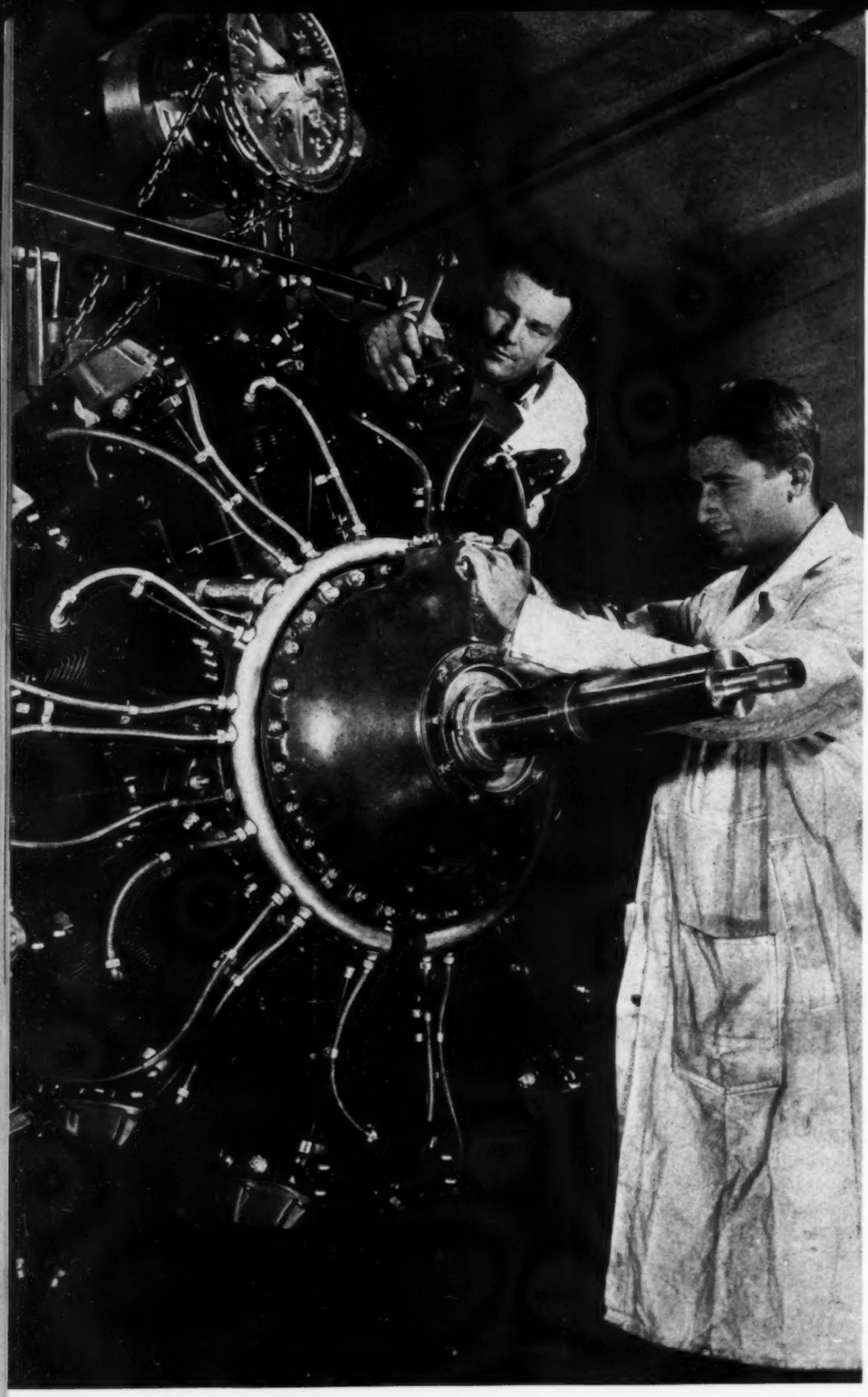
2. High school courses at Cincinnati for engine assembly and testing.

3. Utilization of vocational schools with machine shops.

4. Night courses at the University of Cincinnati for the more advanced phases of tool engineering work and inspection.

5. Transferring between 300 and 350 foremen, sub-foremen, and leadmen from Paterson to Ohio to serve as the nucleus for the Cincinnati personnel.

6. Sending the few skilled craftsmen available in the Cincinnati area to Paterson for advanced instruction in aircraft engine manufacturing methods.



UNDER THE SUPERVISION of a veteran instructor, this future test engineer is making final adjustments on the propeller section of a 14-cylinder Wright Cyclone engine. Of the 14,000 new employees Wright Aeronautical Corporation expects to put on its payroll when its Cincinnati plant reaches full production of 1,000 airplane engines a month, 84 percent will be skilled or semi-skilled. Most of them will be graduates of the company's extensive vocational training program, which is turning out operators faster than machines can be built for them to run. The new factory will comprise 2,120,000 square feet when it is complete.

STUDYING THE CUTTING TOOL OPERATION as an engine lathe turns a steel shaft to size, in one of the vocational schools the company is operating in the Cincinnati area. Wright's training project will supply one-fourth of all workers needed for America's aircraft engine manufacturing industry up to the end of 1941.

Turns Out Defense Workers Fast

THE TECHNIQUE of radial drill operations—more particularly the action of a drill on the crankcase of a 14-cylinder Wright Cyclone aircraft engine—is being demonstrated to a group of trainees. Thousands of young men in the Cincinnati area were interviewed, and those meeting the requirements were enrolled in the Wright training program. Foremen who come in direct contact with trainees are taught the most up-to-date methods of showing standard operations to "green" men.

AIRCRAFT ENGINE BUILDER in the making. This young student in one of the Wright training courses is learning to use a gage in checking the master and articular rod assembly of a 14-cylinder Cyclone airplane engine.

TRAINEES STUDY airplane engine production under the expert tutelage of an experienced supervisor. Here a group of youngsters are being shown how to use a micrometer to check the size of a part finished on a turret lathe. Last year the Paterson, N. J., Vocational School, using the Wright training plan, and instructors and machines from the Wright plant, placed 2,700 new machine operators in the five Paterson plants. Of this number, only sixteen proved incompetent.

Carter Products, Incorporated

1. Estimating Without Benefit of Costs

JOHN H. HILL

Carter Products is a fictitious company, but its troubles are quite similar to those that beset many an honest - to - goodness plant, today and everyday. The author, John H. Hill, is now an industrial engineer at the Bundy Tubing Company, Detroit, specializing in time and motion study. A variety of experience—he started with Cadillac when he was fourteen and has since worked for Peerless Motor, Thompson Products, George May, Hudson Motor, Bridgeport Brass, and others—enables him to speak with authority on many aspects of factory management, or mismanagement. He has been in charge of group incentive plans, assistant to the superintendent, and production manager. Another article by Mr. Hill is scheduled for an early issue.

IT IS BECAUSE Carter Products, Incorporated, is so different from all other companies that I know you will be interested in some of the things that happen here. It is different in one or two details . . . like the fact that, whereas, in your company the production manager is a disagreeable cuss, in Carter Products, the superintendent is a disagreeable cuss—and the son-in-law of the Old Man.

Then, too, I've heard it said around the plant that "We're different; it won't work here. Our customers demand that we give 'em better service," or "our customers demand top quality," or "our customers don't know what they want."

"We tried that years ago," said one of our men to me a few days ago with an air of finality, "it won't work." This ought to convince you that we are truly different from your company, because I'm sure no one ever said anything like that in your outfit. Or did they?

Five years ago, plus two weeks yesterday, I punched my first timeclock at Carter Products. Since then I have been slowly learning how a business should be run. The only trouble with my education is that our competition doesn't run business according to our idea of Hoyle; they discover ways of doing things that aren't supposed to be good practice. If they would only do things the way we're sure they should be done, then Sam Holland, our slightly overweight superintendent, wouldn't have anything to worry about.

And maybe we'd have continued peace around the plant. As it is things are pretty hectic.

Take our estimating. Estimating, according to Webster, is an approximate calculation of the price to be charged for work. In the easy-money days of Carter Products, the "price to be charged" was the major consideration. It had little to do with costs, because the price was adequate to meet them.

Despite quickened competition, we still operate on the principle that market prices are more important than operating costs.

For instance, Art Hemsley is foreman of gadget assembly on the third floor. Three weeks ago we got some blueprints from Burse Lamp for a new type of adjustable floor lamp, and the estimating department asked Art for figures on it. Between two and four in the afternoon, he scratched some figures on a slip of paper and turned them in. Between the same two and four that afternoon, he rushed through sixteen jobs for the so-called planning department, handled a union grievance, signed three of my time studies, and ran out of stock on BM's assembly job.

Now it so happens that Art was a little off on his estimates . . . on the low side, this time. Usually Art tacks

(Continued on page 184)

". . . between two and four he rushed through sixteen jobs, handled a union grievance, signed three of my time studies, and ran out of stock on BM's assembly job. . ."

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

HANDLING, LAYOUT, MOTION ECONOMY

Two snips with a pair of shears is the only effort necessary to open this safety box

New, Safer Shipping Box Makes Good Re-Use Container

SOURCE
Caterpillar Tractor Company
Peoria, Ill.

Hand and leg injuries caused by nailheads protruding from boxes after they had been opened, eye injuries from nailheads and splinters flying as the box was pried open, and foot injuries from nails sticking up either from box lid boards or from wood-block floors where they had lodged in dangerous position, set two men in the receiving and unloading department thinking about ways to eliminate the danger. Since the difficulties all came as a result of opening nailed-on box lids, the obvious way to get rid of these difficulties was to get rid of nailed-on box lids.

They designed a box with a one-piece lid that can be lifted off. The end braces or cleats of the box are on the exterior, and project above the sides and ends by just the thickness of the lid. These projections prevent the lid slipping endwise. To hold the lid down tight and keep it from slipping sidewise, half-inch steel strapping is applied around the box near each end. Cost of the closed box is less than the cost of a nailed-lid box.

Desirable as the added safety is, it turned out to be of less significance than the other economies. When the company induced a supplier of nut, bolts, and screws to use boxes of this design, opening the box became merely two snips with small shears. And the emptied boxes were so obviously ready for re-use that the company began filling them with parts and supplies for shipment to distributors, restrapping them, and sending them on their way. Distributors, in turn, re-use them for shipments to their customers. All that is needed for re-use is to equip the shipping room with the strapping tool.

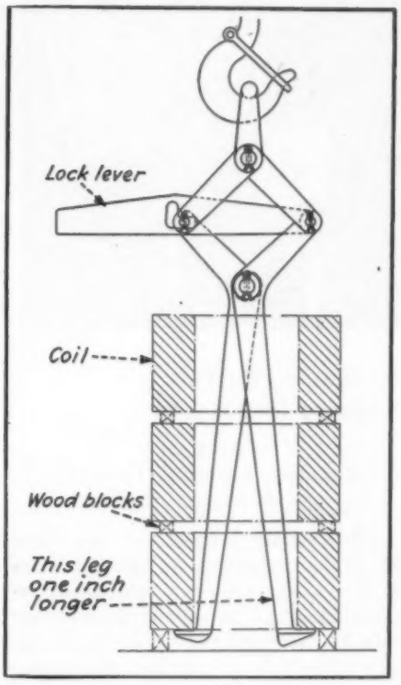
Today, approximately a year afterward, 25,000 boxes are received annually from the supplier with whom the plan was first worked out, and about the same number from all other suppliers. The supplier marks the box with Caterpillar's name, not his own, thus making it an appropriate shipping container for the company's use. Thus Caterpillar is saved buying 50,000 boxes a year, on top of the savings from added safety and decreased cleaning and hauling from the receiving room.

•

Special Tongs Speed Steel Coil Handling

H. ROY STACKS, *Detroit*

We have specially designed tongs for handling and piling coils of stainless steel. These coils measure approximately 24 inches in diameter, 12 inches wide, and have a core of 15 inches. From one to three coils must be lifted at a time by a crane, and piled on their sides. Four wood blocks are placed between coils so that the toes of the tongs can get under each coil.

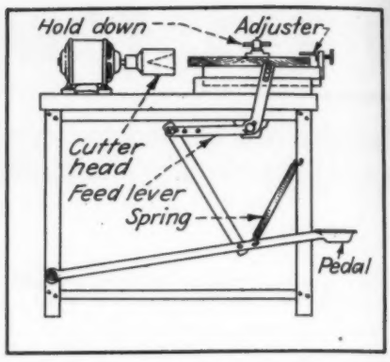


The design features of these tongs are a lock lever which makes it possible to lock the tongs in closed position, and

one leg one inch longer than the other. The fulcrumed lock lever is mounted on two of the four toggle pins, pivoting on one pin at one end, and sliding in a 90-deg. slot at its midpoint on another toggle pin.

When the crane is carrying the tongs empty, the legs of the tongs are closed, and the pin moving in the slot is at the top of the slot's vertical arm. In this position the tongs can be lowered within the steel coils. A ground man gives the lock lever an upward blow, allowing the legs to spread due to the weight of the tongs. The toes will engage under the coils ready for lifting and carrying.

In setting down the coils, the bottom coil comes to rest on the wood blocks which are thick enough to give the bottom coil at least 2½ inches clearance from the floor. Then as the tongs continue down toward the floor with the weight removed, the longer legs hit the floor. This removes the tongs' own weight from the tongs, and they close. This causes the toggle pin in the lock lever slot to slide along the slot until the vertical leg of the slot drops down over the pin, locking the tongs in the closed position. They can then be lifted out of the coils preparatory to picking up the next load.



PRODUCTION METHODS AND MATERIALS

No Waiting for This Branding Iron to Heat

SOURCE
Monsanto Chemical Company
Monsanto, Ill.

Ed Kassing, foreman of our warehouse and shipping department, has been playing with fire, with good results. He has developed a branding unit for marking the hundreds of carboy boxes handled through his department. He worked out the idea because he felt that too much time was wasted in heating and reheating the brand for each box.

Here's how it works: The brand is raised slightly and held in position by a pin through the shaft; blowtorch burns, brand heats, pin is removed, brand descends on box, scorches, is raised again to heat while the operator moves to next box. Kassing has been using the branding gadget daily for several weeks and finds it both easy to operate and efficient.

•

Stakes Pointed Faster With New Cutter and Jig

G. J. NELSON, *Superintendent*
Dakota Sash and Door Company
Aberdeen, S. D.

During the course of a year we make quite a number of grade stakes for road contractors. These stakes measure 14 to 18 inches long, 1x2 and 2x2 and 1x1 inches in width and thickness. In the past we have been pointing these stakes on a movable table saw, which means turning each stake three times to cut four sides. The most one man could produce by the old method was 300 stakes per hour. By our new method, one man can point 800 to 1,000 stakes per hour.

This stake pointer is very simple. From a piece of 4-in. shafting we had a cutter head made similar to a pencil sharpener. Then this head was put directly on a 1-hp., 3,600-r.p.m. electric motor shaft. A jig was made in front of this cutting head to hold the stakes, with a hold-down lever to keep them from twisting while being pointed. The stake holder was made to slide forward and backward by the action of a foot lever. This machine can point stakes as fast as an operator can feed them.

Management, How Good Is Your Control?

Ask yourself these questions to check up

9. PARTS SHORTAGES

1. Are parts coming into the section on schedule? Which ones are not? Where do they come from? What is the cause of delay? What can be done?
2. Are assemblies received complete? Are shortages due to faulty checking?
3. Can any assemblies be partially completed while waiting for parts shortages?
4. Are any parts shortages due to jig difficulties? What can be done about them?
5. Are there any small parts shortages? Are they due to any lack of foresight on your part? Is your system for ordering and keeping on hand miscellaneous stop nuts, screws, bolts, working satisfactorily?
6. Do you try to rectify shortages by personal call at the department? By telephone? By stock chaser? By reporting to your superior?
7. On large assemblies, could shortages be reduced by maintaining a small reserve stock of parts for five, ten, or some greater number of units?
8. In what department do most shortages occur?
9. Do you keep a record of parts consistently short? What do you do about this?
10. Through what means do you get the best results in making up shortages?

Next Month: Waste

Prepared by HARDING PALMER, *Industrial Engineer*
Lockheed Aircraft Corporation, Burbank, Calif.

MAINTENANCE SERVICES

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INSTALLATION

INSPECTION

UPKEEP

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FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorials

MAINTENANCE AS THE EDITORS SEE IT

When You Prevent There's No Need to Repair

OUT OF MORE THAN 600 MOTORS IN OPERATION, only one failed last year. This record was hung up by the maintenance department of an old plant that is now working full blast on products essential to the defense program.

Such a happy situation did not always obtain. A large portion of the motors in this metal-working plant are from 25 to 35 years old. With few exceptions they are of the open type. Exposure to cast-iron dust is severe. Under these conditions it is not surprising that failures used to occur with monotonous regularity.

The necessity of getting maximum production from every machine in the plant brought about a carefully planned schedule for motor and control inspection. Under it this equipment is subjected to rigid, frequent examination and immediate attention to all weak spots.

With such a schedule in effect failures dropped precipitately. Production rose to a gratifying extent. Management smiled happily. Maintenance patted itself on the back and admitted it was pretty good.

It's an old, old, story, of course. But it's worth repeating over and over again in every plant where the function of maintenance is looked upon as repair, rather than the prevention of trouble.

Here's to More Value From Your Painting Dollar

TIME TO PAINT UP is about at hand. During the next few months untold quantities of paint will be brushed or sprayed onto countless millions of square feet of steel, wood, concrete. All this material and the labor for applying it will be expended primarily to protect the various surfaces from attack by destructive influences, including the weather, or to improve the appearance—or both.

In most instances the user will be at least reasonably well satisfied with the results. Inevitably a certain percentage of users will be disappointed. Reasons for failure of the protective coatings to live up to expectations will usually lie in careless selection of the material; improper or insufficient preparation of the surface; application in ways or under conditions that make satisfactory service almost impossible.

In the April issue we presented recommendations covering the general types of protective coatings to be applied to the more important surfaces in and around industrial plants. It is hoped that these recommendations will help plant operating men to get more value out of every dollar spent for painting. This end can be achieved more easily if it is recognized that it is not the purpose or intention of these recommendations to exclude the use of any materials that have proved their worth in service.

Advances in paint technology have been numerous and important. New vehicles and new pigments or combinations have come into wide use. It would be a mistake, however, to assume that they have displaced some other materials that have been used for a great many years with eminently satisfactory results. Graphite and iron oxide are two outstanding old pigments whose names come instinctively to mind and are synonymous with unsurpassed service.

In the field of surface protection, as in many others, any desired result can oftentimes be achieved in more than one way, or by more than one combination of materials. Hence the user of paint and practically every other commodity must consider the wisdom of determining by test and trial the material or product that gives the best service under his conditions.

If Lubrication of Equipment Gives You Trouble

PROPER LUBRICATION of equipment is always an important matter. It becomes worthy of still more attention when machines are being operated 16 to 24 hours a day.

In times like these, methods of applying lubricants become of particular moment. Under normal operating conditions there is little difficulty in finding time to give each bearing the attention it needs. If a machine has to be shut down for a moment to get at some bearing, the resultant delay may not be serious.

Not so today. When maximum output can hardly keep pace with demand, any delay that is not absolutely unavoidable is difficult to justify. On the other hand, applying lubricants by hand when machines are running increases injury hazards, as well as the possibility that hard-to-reach bearings will be neglected.

Many plants have found a ready-made solution of these difficulties in automatic or manually operated centralized systems and other means of making lubrication safe, easy, and certain. With properly engineered installations risk of personal injury is eliminated, no bearing can be neglected, and the number of machines that can be serviced by one man is increased many fold.

We Keep 3,000 Motors Working

Electrical tests at regular intervals prevent breakdowns (a stopped main conveyor can keep as many as 600 men idle) and maintain a steady flow of parts to assembly lines

C. C. WILLIAMS
Plant Engineer
Plymouth Division of Chrysler Corporation
Detroit

C. C. Williams began his career as a switch tender in Toledo. Shortly became station master. Served for a while as inspector in a glass plant, followed by some time as tool inspector in the Chalmers Motor Company. Left this position to become superintendent of a steel-ball plant, but returned to Chalmers, which by then had been combined with Chrysler Corporation, as shop engineer. Mr. Williams then spent two years laying out the Kelvinator factory; when he again returned to Chrysler it was to install the new Plymouth plant. Later installed the Plymouth plants in Los Angeles and Evansville. Factory readers will remember Mr. Williams's "Always 70° in the Machine Shop," February, 1939

HUNDREDS of independent processes in the modern automobile plant are handled by electrical equipment, which must be coordinated to permit an even flow of parts to the main assembly lines.

More than fifty men are required in our electrical maintenance department to keep some 3,000 motors in running order, and to attend to the many other items of electrical equipment involved.

Broadly, all maintenance, including electrical maintenance, may be divided into three classes:

1. Systematic system of inspection of all equipment to see that it is in good condition, or, if found defective, to replace it before a motor failure stops production.

2. Repair after breakdown. This may be spectacular, certainly it is very expensive, because a stoppage of a main conveyor will throw over 600 men out of work for the duration of the break. Naturally, our periodic inspections are designed to prevent this sort of thing.

3. Repairs to prevent a breakdown. Here again periodic inspections and minor adjustments constantly work in the direction of prevention.

The first is obviously the best, and it is now my purpose to outline the various tests used to keep electrical equipment in order and thus to avoid breakdowns.

The wiring on all automatic machines is inspected each week. One man travels between generators, synchronous motors, and transformers. He checks insulators, oil switches for heating, motors for cleanliness and for assurance that excitation is high enough for maximum power factor correction, brushes and commutators for cleanliness and wear.

If this inspector finds something wrong that he cannot fix with a screwdriver and an oilcan, he makes out a machinery and equipment inspection report and turns it in to his foreman. Since only tests and methods of testing form the basis of our present interest, the routine paperwork will be left to a later article.

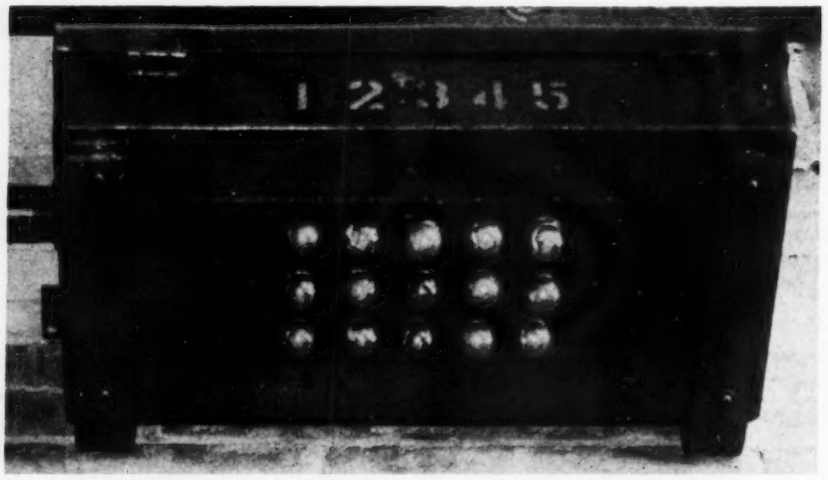
Transformers are kept out of trouble by yearly inspections and by dehydrating the oil every 18 months.

A recording power-factor meter is used on secondary feeders each year. Since we change models, and hence rearrange machines each year, this means a test whenever machines are moved, or new ones taken off a secondary. If the power factor is not up, and ours is around 95, we know what machines have been changed and can proceed accordingly.

If the power factor is found to be low, a recording watt-hour meter is used on the questioned machines for several repetitions of the operation, to see if the load corresponds with the motor

rating. If over-motored, the motor is replaced by the proper size from our stock. Generally, the recommendations of machinery makers as to size of motor are followed; frequently, however, this results in oversized motors which must be replaced. When the correct size is secured, the watt-hour record is kept so that future complaints from production can be traced to tight bearings, increased stock removal, or dull tools.

When an overload relay kicks out, or a fuse blows, the electrical maintenance department gets the call. After the third call on a piece of equipment, the wattmeter is put on to determine which of the above three reasons is the cause of the trouble. If the machine is undermotored, a motor of the right size is installed. In this way overheated bearings because of oil stoppage and faulty feeding by inexperienced operators are discovered and quickly remedied.



Fifteen signal lights, one for each phase of the secondary transformers, in central maintenance department. When a ground occurs, it can immediately be traced

A Flexible Tool

The snap-on ammeter is a flexible tool in the maintenance department. We use it to solve such problems as this: Can the r.p.m. of a ventilation fan be increased to deliver a greater volume of air in a department? We had two 7½-hp. motors operating fans in a department when production required a greater volume. The fans and motors were the same, but the duct system, and hence the air resistance, was different. The snap-on ammeter indicated that one motor was pulling 4 amperes and the other 10 amperes because of these differences in the duct system. Of course, the motor drawing 4 amperes could be speeded up, but we had to put the recording wattmeter on the other to check whether the load was constant at 10 amperes.

Again, the clip-on ammeter is used when a fuse blows or an overload relay trips, to see if the load corresponds with the motor rating. Detail analysis of load characteristics is, of course, made by the recording watt meter. Fortunately, voltage variation is not a factor.

We have an induction ring expander with two coils that have different voltage taps. By changing these, the heating may be hastened or retarded as desired. When the coils were installed, the snap-on ammeter was used to determine whether the coils had the correct number of turns.

Another chore for the versatile snap-on ammeter, and an interesting one, is adjusting the load equally on two drive motors used on one very long curving conveyor. Of course, a tachometer reading on the gear-reduction shaft of each motor could have been used, but this would take much longer than the ammeter. It was found that one 1,200-rpm. motor had, under load, dropped to 1,175, the other to 1,125; the fast motor would begin to drag on the slow. The ammeter was used to move the motor drives to the center of the load and hence secure an equal pull. Another way of solving the same problem would be to adjust the speed through the gearbox so that both motors pulled equally.

The snap-on ammeter is frequently used to determine whether a motor should be rewound; we do not wait for a burn-out. If a motor is running hot, the load may be normal as determined by the recording wattmeter described above; the bearings may be at fault; or the rotor may have dropped. The motor inspector snaps the ammeter on all three legs to determine whether turns are shorted out in some phase; this will indicate the need for a rewind which he reports on a machinery and equipment inspection report. The motor is changed, and the defective one brought in for rewind.

However, the importance of continued production may dictate running the chance of a burn-out to avoid closing down before the end of a shift. In this case, the protective relays are plugged and the motor is kept in operation; an air hose is used to keep the motor as cool as possible during this time. Even though a motor change is a matter of minutes, and we have spares available, it does not pay to have several hundred productive workers stand idle while a change is made.

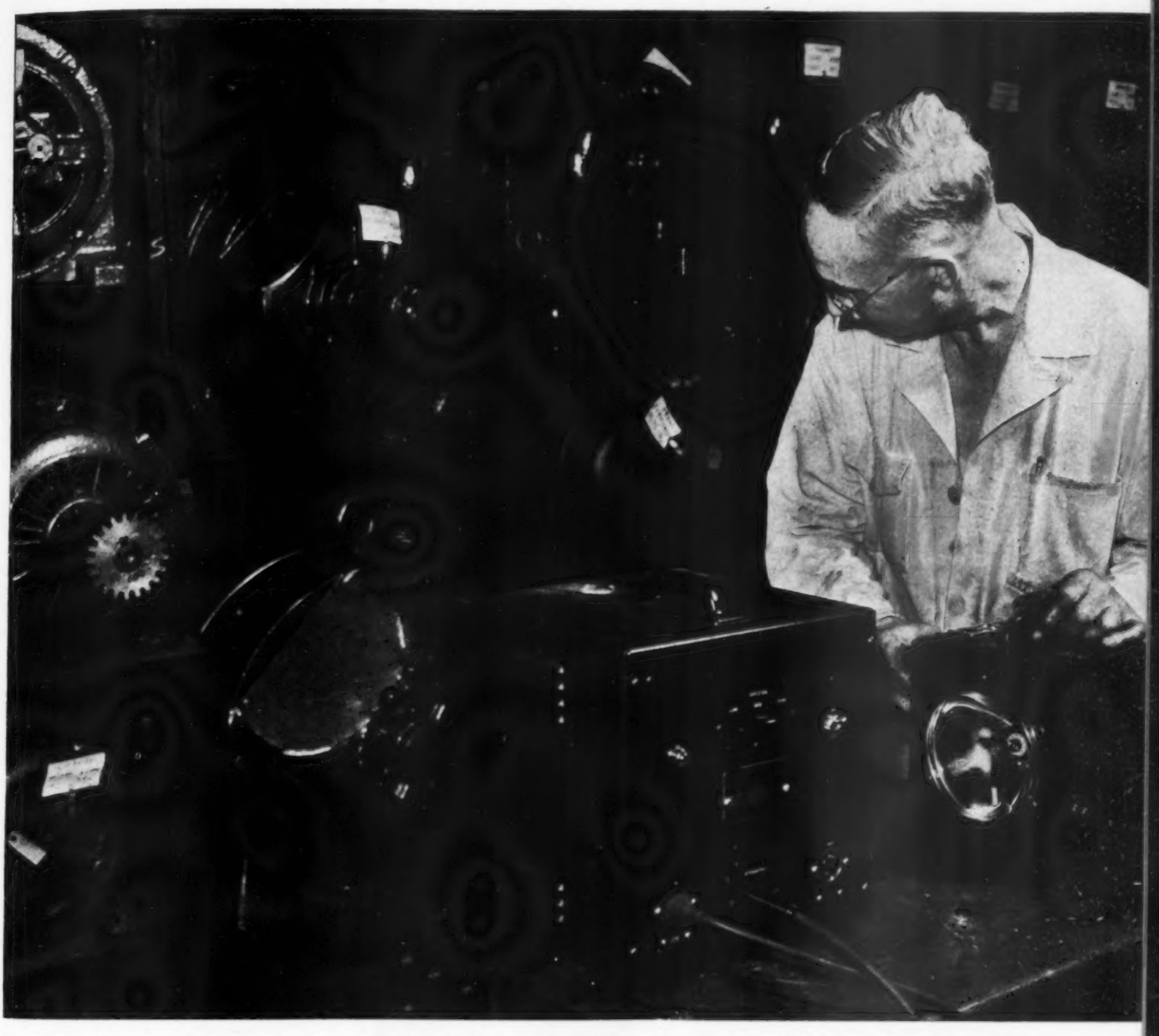
Exact Temperature Control

Ovens are necessary in automobile manufacture; in many cases the temperatures must be controlled within plus or minus 2 degrees. A potentiometer is used to set, and to check, heat-recording instruments on all ovens and furnaces. This is done every 3 weeks.

Another essential instrument in electrical testing and maintenance is the megger which is used to test all circuits and motors for insulation breakdown. When a motor comes to the central department for repair, a megger is put on it. If there is a breakdown, it is rewound. This test instrument is used on all automatic machines or control devices when the wiring is completed. It is also used immediately when any defect shows up.

We have five banks of secondary transformers. On the ceiling of central maintenance a bank of lights is provided, one for each phase, or 15 in all. We know which department is served by each phase, a ground, therefore, is immediately traced to the proper department. With a ground on two phases, the fuse will blow. If there is a ground on one phase, a switch is hooked to another phase—one side of the switch to a ground, the other side to another phase—and a 100-amp. fuse is put in. Usually the wire will burn through before the fuse. This locates the ground by wire burning, for it isolates the affected machine by sight, or when the equipment in the department is started the grounded machine with the burned wire will fail to start.

A newcomer, and a very important



Electrical maintenance finds stroboscopic equipment a valuable aid in studying rapidly rotating and reciprocating machine members

one, to the kit of instruments used by electrical maintenance is the stroboscope. The principle involved is too well known to require description, but its use by the maintenance department is, I believe, quite new. We use it to check the speed of shafts, pinions, and gears where the use of the more familiar tachometer would be inconvenient or impossible on account of the design of the equipment. Our most frequent use for it is in checking worm gears. By stopping the gear we can tell what is taking place, the condition of the contact, or the worn condition of the keyway. A step-up is provided which boosts the light to a point where the instrument may be used in the shop in broad daylight.

An Unusual Application

A test was made on a crankshaft grinder which illustrates the value of this instrument to maintenance quite well. We wanted to determine if belt slippage was a factor. A chalk mark was made on the circumference of the grinding wheel, and the period of the stroboscopic instrument adjusted to that of the speed of the wheel while idle. The wheel then, of course, was standing still. When the shaft was fed against the wheel the latter began to slide back as indicated by the chalk mark. This was an indication of belt slippage in the sheaves, and the machine was turned over to the machine repair department for remedy.

All these various tests and inspections are for one purpose—to keep the thousands of electrical mechanisms operating so that completed cars can roll off the final assembly lines according to schedule.

Sixty Acres of Roof to Maintain

Five men on the roof all the time. That's Caterpillar practice—and it may sound like a lot of "overhead" expense. Fact is, a little simple arithmetic proves that it pays

C. Y. CHAPMAN
Superintendent, Buildings and Grounds
Caterpillar Tractor Company
Peoria, Ill.

ROOF REPAIRS simply cannot be put off. A plant that tries to skimp on roof maintenance, that permits leaks to persist for lack of attention, is merely compounding the costs to which it will be subject. If water gets inside the roof, it deteriorates a lot faster than if no break had been allowed to occur. Unchecked, a leak rots out the sheathing and this usually means tearing off everything all the way down to the purlins—which involves considerable expense and inconvenience.

Our roof maintenance policy is based on this knowledge, and on the further indisputable fact that a roof leak is likely to cost us several times as much in damage to materials and machinery, and to production costs, as the cost of preventing the leak in the first place. So we apply to our 60-odd acres of roofing the same general policy of preventive maintenance that we find desirable throughout our plant.

Nucleus of our roof maintenance is our roof gang, consisting of five men who take care of all our roof maintenance and inspection.

Five-Man Gang

The five-man roof gang is headed by a working boss, a man experienced in the roofing trade. With him are two other roofers, trained on our job, a man who tends the tar kettle, and a carpenter who handles repairs to roof boards and other wooden portions that may be involved.

The first duty of the gang is to cover its regular beat. This means that every week it must go over every roof in the plant. The crew's responsibility on this tour is to clean the gutters, downspouts, and roofs in general, of any dirt or debris. Actually this requires only about one full working day per week, although the job is spread all the way across the week because it is interspersed with other work. The dirt and litter found on these cleaning expeditions is put in containers and lowered over the side.

In the course of the cleaning up, the man in charge of the crew is responsible for keeping his eyes open for any needed repairs or replacements. Thus, in effect, we inspect roofs all the time. If he sees a roof that needs replacing, he reports it to the superintendent of buildings, and together the two men go over it. If they agree that major repairs or a new roof should be recommended, they ask the plant engineer to issue an order. If a sheet-metal flashing needs repairs, the job is turned over to the sheet-metal department.

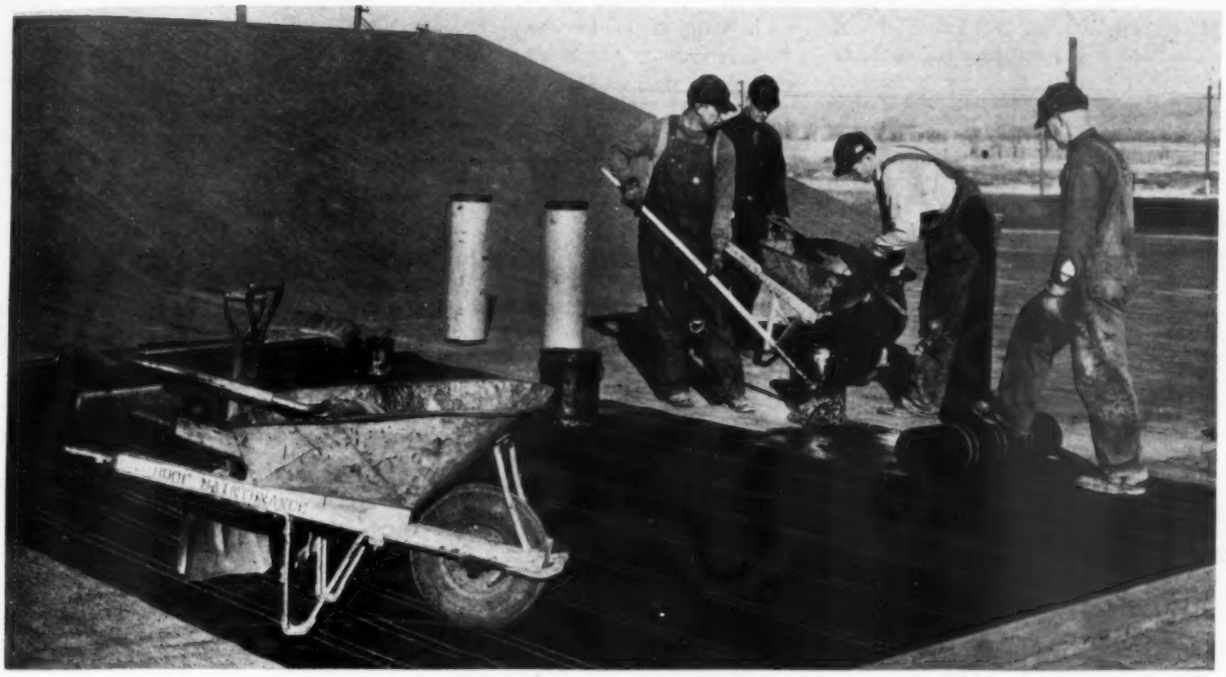
A native of central Illinois, C. Y. Chapman began his career as his father's associate in the building business. Later he formed his own contracting company. Employed by Caterpillar Tractor Company in 1918, in the maintenance division of the plant engineering department, he is still with the same company

Our roofs are in general 20-year-guaranteed roofs, and we know from the records just about when to expect to repair or replace each one. Since we have more than 60 acres of roof, on the 20-year basis this means we replace approximately 3 acres a year—which is actually how it works out. Most of our roofs are flat tar-and-gravel surface, others are sloping and are plain surface 4-ply saturated felt with asphalt. Anyone with even a limited experience in roof maintenance becomes familiar with the indications that a roof needs attention. On a tar-and-gravel roof it is only necessary to rake back the gravel to see that the saturation of tar is disappearing, that the life has gone out of the felt, and that it is cracking. On a plain-surface roof the same thing becomes apparent without the necessity for raking back any gravel. Actually most of our roofs are mopped felt—we use the best grade of Trinidad Lake asphalt because we think it an economy in the long run.

Before Leaks Start

Our intention—never, of course, fully attained—is to catch roof deterioration before the roof starts to leak. This cannot be achieved because, with such large expanses of roof, cracks are bound to develop merely from expansion and contraction. Likewise freezing and thawing are hard on broad roofs. When a rain comes the operating departments of the plant notify us of any leaks important enough to let perceptible drips through.

Also, the plant protection department turns in reports of any leaks, which its men may find in the course of night patrols in portions of the plant not working on this shift. If a leak is bad enough to do any imme-



Here you see the application of roofing felt over a small portion of roof, made necessary by the removal of an exhaust stack. The procedure is to remove the supporting headers, cut the sheathing back to the regular purlins, and replace the sheathing. When done in this manner it shows no indication of a replacement having been made, if viewed from the under side. The plies of felt are mopped with hot asphalt in the usual way, after which the entire surface is given a mopping of asphalt

diate and serious damage, the roof gang pitches in and repairs it even in the rain—which, incidentally, is such a hindrance to efficient work that it materially boosts repair costs for such a job. Lacking any immediate jobs of stopping leaks, the roof gang men are sent out separately to look for leaks of the less obvious type, and to trace them to their origins, which as any maintenance man knows are likely to be many feet away from the point where the water makes itself noticeable. All leaks that do not require work during the rainstorm are noted for patching at the first opportunity.

Crew Kept Busy

In winter, the same crew is kept working, though on different types of activity. The carpenter and the kettleman are transferred to other jobs, and are called back to roof work only when some specific need arises. But the others are kept busy on roofs. They remove snow and ice. They clean frozen gutters and downspouts—even though most of our downspouts come through the interiors of buildings, it is possible for them to become clogged at the intake. If we have a really big snow, or a succession of snows coming too frequently to permit the crew to keep abreast of the accumulation, we transfer some yard laborers to the roofs to get the snow down before it can do any damage. A big snow or a drifting snow may get piled up above the flashings and cause some real damage by melting, if it is not shoveled off in time. Also, the roof's snowload may become excessive and do some damage to structural members. After all, what we are after is to prevent damage instead of repair it.

One reason why our roof gang can cover so much territory and still do justice to the requirements of the job, is that they are not called upon to keep raising, lowering, and moving ladders. All our buildings have steel ladders permanently affixed and leading to the roofs. On sawtooth sections, ladders lead up from the valleys to the peaks. This saves a tremendous amount of time for the roofers. The primary purpose of having the fixed ladders is, of course, fire protection.

Rubber-Tired Barrows

Another point worth mentioning is that we save damage to roofs by men working on their surfaces, by equipping the roofing gangs with pneumatic-tired wheelbarrows. The ditches that can be pressed into a roof by a steel-tired wheelbarrow on a hot summer day, make excellent starting points for future leaks. The rubber-tired barrow leaves no tracks behind. The crew runs the barrows up with any other equipment needed, using the hoist that they carry with them at all times.

Simple Arithmetic

Keeping actually five men on roof maintenance continuously is a big enough expense so that periodically we are called upon to explain why this is worth its cost. The answer to that is obtained from pure arithmetic. The roofs are deteriorating at least by 5 percent a year, plus any special damage that they may suffer from unusually difficult conditions. And the cost of the roofing crews, their equipment and supplies and materials, totals up less than 5 percent of the original cost of the roofs. The difference between the actual cost and the theoretical deterioration is, of course, clear profit for which—in a world where maintenance men could set the rules—the building department is really entitled to a credit entry on the ledgers.

Network Distribution Answers New Production Needs

Differing from the radial type in several important respects, it is more reliable, has far more flexibility under shifts in load, and limits short-circuit currents

G. A. CALDWELL
Application Engineer, Westinghouse Electric & Manufacturing Company East Pittsburgh

WHEN A PLANT puts up a new factory, or builds additions to the old one, the matter of a new electrical distribution system automatically comes up.

If the expansion program involves only a comparatively small addition to present facilities, the distribution system adopted is usually an extension of the existing system, provided it is at all satisfactory. When the expansion is of a major nature, however, or if the new facilities are to be located at a point remote from the present buildings, the type of distribution system can be selected on its own merits.

The distribution system commonly used today is of the so-called radial type. A simple form of this system is shown in Figure 1. Assume that it is installed in a factory building one story high, 200 feet wide by 600 feet long. Load consists largely of machine tools distributed rather uniformly throughout the building. Estimated power demand requires a 2,500-kva. transformer bank. The power company provides two high-voltage feeders delivering energy at 13,200 volts, three phase, 60 cycles. From the transformer bank, power is delivered at 440 volts and suitable switching facilities have been installed to connect the transformers to either source of power supply.

It has been assumed that it is desirable to distribute power from six points approximately equally spaced in the building. Each distribution bus is connected to the main bus by means of two parallel circuits, each circuit being installed in a separate conduit and consisting of three 500,000-circ. mil, single-conductor cables. An 800-amp. air circuit breaker with an interrupting capacity of 50,000 amperes is installed at the main distribution bus for each feeder. From each distribution bus suitable three-phase cables lead to the various machine tools and other loads in the plant.

Some form of this basic system has been considered standard for many years, and it is a simple, well-known method for distributing power in industrial plants.

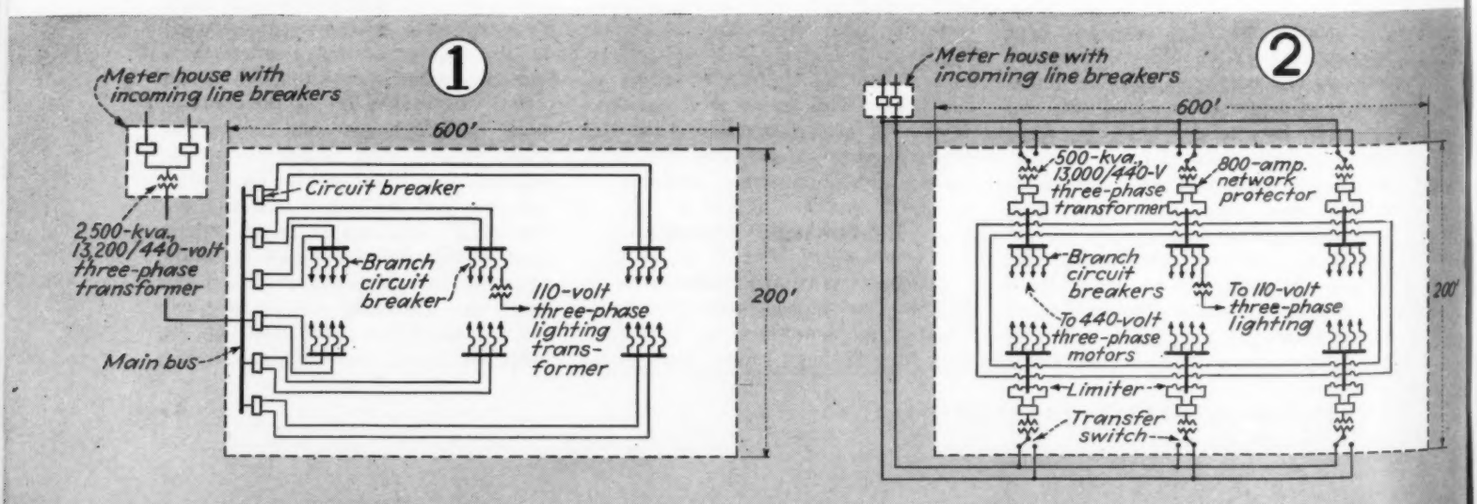
In plants such as shown in Figure 1, where there is a fairly high concentration of power, say 20 to 30 kilovolt-amperes per 1,000 square feet, in a large number of a.c. motors, the network system of distribution is very satisfactory and has certain advantages over the radial system.

While the radial distribution system is old and well understood, the network system is new to the majority of industrial users of power. The low-voltage network was introduced by the power companies about 20 years ago into the metropolitan centers where there is a high concentration of both power and lighting loads. Here continuity of service, good voltage regulation, and elimination of flicker in the lighting circuits were demanded.

Apparatus developed for that appli-

Figure 1. Most industrial plants use the radial system of electrical distribution that is shown here

Figure 2. Network systems are supplied by several transformers whose secondaries are connected in parallel



cation is available and suitable for industrial applications. The basic plan of the network system of distribution is to have distributed around the plant a number of small transformer banks whose secondaries are connected in parallel while the primaries are supplied from two or more sources of power. A typical installation is shown in Figure 2. It has been designed to serve the same factory as the radial system that Figure 1 shows.

The system in Figure 2 has six 500-kva. transformers placed at various points in the plant that correspond to the location of the distribution buses in the radial system. It uses the same two sources of 13,200-volt primary power, and two duplicate high-voltage feeders run to all six of the network transformers. Manual-throw primary switches are located at each transformer and make it possible to connect the transformer to either primary circuit. Under normal operation three transformers will be fed from one circuit and three from the other.

Sufficient for All Six

Each circuit has sufficient capacity so that in an emergency all six transformers can be connected to it alone. Transferring from one circuit to the other can be done without opening the feeder breaker, since the manual switches will interrupt the magnetizing current of the transformer. These switches cannot be opened until the network protector on the secondary side of the transformer is opened, removing load from the transformer.

The cables that connect the transformers in parallel on the secondary side are commonly referred to as the grid. Actually, the wiring arrangement consists of two groups of three single-phase cables between the six distribution buses, as indicated in Figure 2. The combined current rating of the cables is equal at least to the rating of one network transformer.

Each group of cables consists of three cables in a separate conduit. Such an arrangement is usually more economical than a single group with larger cables and gives better voltage regulation. Also, if one of the cables fails it can be isolated without breaking the network.

For the same reasons two circuits are usually used between the transformer and the distribution bus.

A network protector is connected between each transformer and the secondary grid. A typical unit is shown in Figure 5. It consists essentially of a circuit breaker with electrically operated closing and tripping mechanisms and the necessary control relays. Network protectors are not intended for the protection of the secondary grids, but are used to protect service against transformer and primary feeder faults by means of directional relays that operate to trip the protectors when the power flow is reversed. The network protector also functions automatically to connect its associated transformer to the secondary grid when, and only when, voltage conditions across its open contacts are such that its transformer will supply load to the network when the protector closes.

Conventional city networks are practically always laid out on the basis of a three-phase, four-wire system having a phase voltage from line to neutral of 120 volts, which can be used for lighting circuits, with 208 volts available between phases for three-phase power circuits. On a city network where a large percentage of the total load is imposed by lighting or small single-phase motors, and the remainder is in reasonably sized three-phase motors, the voltages used are the most desirable.

G. A. Caldwell, a native of Connelsville, Ind., was graduated in electrical engineering from Purdue University in 1927. He started with the Wesinghouse Company as a graduate student. Serving in turn as a control, general, and application engineer, he has been engaged for the past 13 years in solving knotty electrical problems in industrial plants

With industrial networks, however, a large percentage of the total load may consist of motors some of which may be rated 200 or 300 horsepower, while the lighting load is a small percentage of the total. For this reason it is sometimes more desirable to use a 440-volt, three-phase, three-wire network in order to reduce the size and number of the secondary cables, and then locate suitable stepdown three-phase transformers at convenient points to take care of the lighting load at 120/208 volts, three-phase, four-wire.

Development of high-intensity mercury lamps and the larger fluorescent lamps gives the possibility of operating lighting circuits directly on the line-to-neutral voltage of the 440-volt network, which is 254 volts.

Both 220- and 440-volt industrial networks have been installed, and advantages can be listed for each. The principal advantage of the 440-volt network is the saving in the size of cables required, since the current-carrying capacity need be only one-half that required on the 220-volt network. A saving is also realized on many of the magnetic controllers for the individual motors especially when the rating is 30 horsepower or more.

Increased Danger?

The objection most commonly raised against the 440-volt system is the increased danger to the operator who must handle pushbuttons and master switches, which carry the high-voltage control circuits. Many machine tool builders now supply control circuit transformers as standard equipment to give a control voltage of 110 volts or less, regardless of the main power supply voltage.

On the original high-current, low-voltage city networks it was found that any secondary faults would burn clear and that no protective devices were needed for the individual secondary cables. Experience has shown that on 440-volt networks the secondary faults may not be self-clearing, and it becomes necessary to use protective fuses at each end of each secondary tie conductor to clear faults and limit damage to that section of the cable. High-capacity protective fuses have been developed recently that are economical and can be installed right in the cable with little complication. This type of protective fuse is intended to provide short-circuit protection only and is commonly referred to as a limiter. Figure 2 shows the location of the limiters in the secondary grid.

The method of distributing power from the distribution points to the

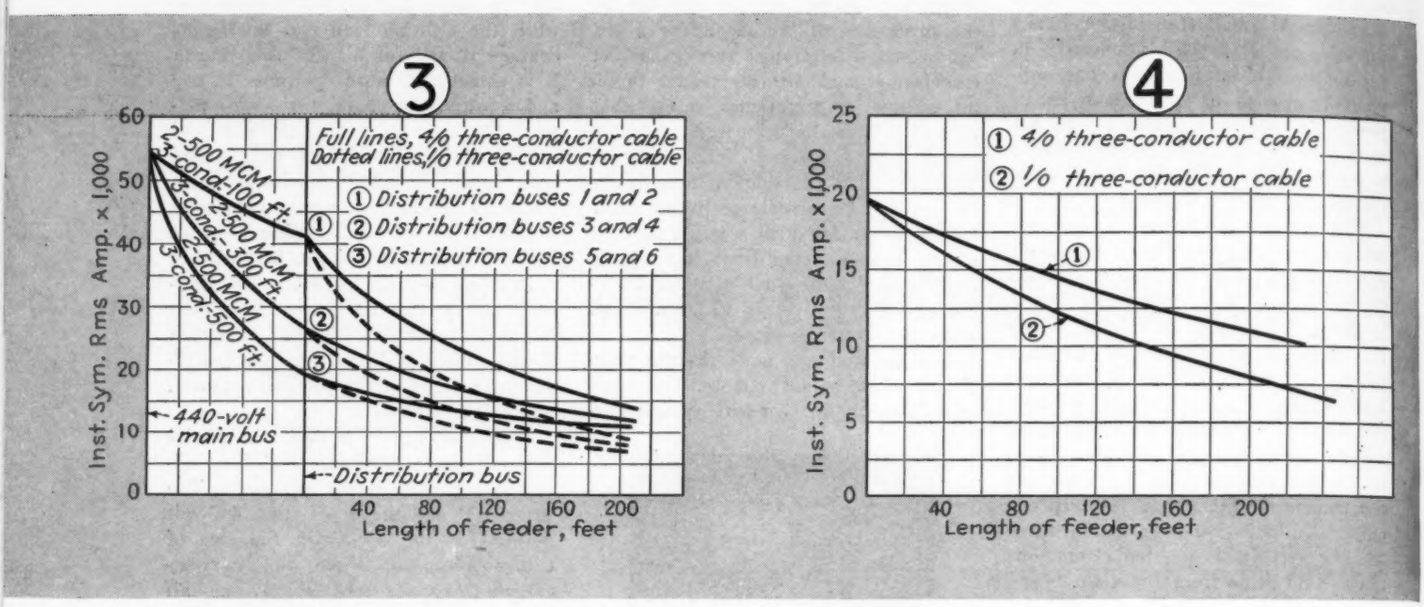

3
Inst. Sym. Rms Amp. x 1,000
Length of feeder, feet
2-500 MCM 3-cond.-100 ft.
2-500 MCM 3-cond.-300 ft.
2-500 MCM 3-cond.-500 ft.
Full lines, 4/0 three-conductor cable
Dotted lines, 1/0 three-conductor cable
① Distribution buses 1 and 2
② Distribution buses 3 and 4
③ Distribution buses 5 and 6
440-volt main bus
Distribution bus
4
Inst. Sym. Rms Amp. x 1,000
Length of feeder, feet
① 4/0 three-conductor cable
② 1/0 three-conductor cable

Figure 3. This chart shows approximately the value of the current that can be expected to flow at any point in the radial type of distribution system illustrated in Figure 1 when a short circuit develops

Figure 4. Less current will flow under a short circuit in the network system, Figure 2, than in the radial, and the variations in current at different points will be smaller

various individual motors is the same for the network system as for the normal radial system. In the system illustrated in Figure 2 a distribution bus is shown for each network transformer, but additional distribution points can be installed at any point on the grid. The system is laid out with sufficient transformer capacity so that any one of the network transformers can be taken out of service and the entire plant load carried by the remaining units.

When a new distribution system is to be installed, some of the points of the two systems that should be evaluated are as follows:

Reliability. The desire to eliminate as far as possible any interruptions in the power supply was one of the main reasons for the development of the network system. In the system shown in Figure 2 a failure in any of the primary or secondary cables is automatically isolated without an interruption in the power supply. A failure in the cables between the distribution point and any given motor load can also be isolated and the only power interruption will be on that particular branch circuit.

On a normal radial distribution system a failure on any of the main feeder cables from the main bus to the distribution bus will result in a power interruption. Even with the installation of two parallel cables there is a momentary interruption. By installing two parallel groups of three single-phase cables, as indicated in Figure 1, with the addition of limiters, a feeder cable fault can be isolated without a power interruption, but there is a 100 percent overload on the other parallel cables unless these cables have a considerable surplus capacity.

With the standard network layout as shown in Figure 2 a failure on any one of the secondary grid cables would still leave five other cables available for handling the load that is normally carried by it.

The importance of the greater reliability offered by the network system must be evaluated for each plant in which it is to be considered. This feature will be more or less important, depending upon the type of operations that happen to be involved.

Flexibility. When a plant is faced with the problem of adding a load to the present system, whether it is a greater concentration of power in a given area or an addition to the present plant, it quite often happens that the main transformer bank and the radial feeder system are already loaded to capacity. Sometimes it is necessary to purchase an additional bank of transformers and since parallel operation of the two transformer banks involves switching complications, a new radial system is established. In the case of the network, which is basically made up of several small transformer banks instead of one large one, it is a comparatively easy matter to add the additional unit to the network already established.

In plants where it is normal practice to rearrange machine tools and other equipment in retooling programs, it is often found that there has been a shift in the concentration of power from one distribution center to the other. With a radial distribution system this shifting overloads one feeder and underloads the other. On the network system, with its secondary grid, such shifting of loads can be handled more easily without overloading any section of the secondary network system.

Voltage Regulation. Reference to Figure 1 indicates that the problems of voltage regulation at the distribution points farthest away from the main transformer bank are going to be greater than for centers close to the transformer, because the cables are much longer. If it is assumed that an attempt will be made to obtain approximately the same voltage regulation at all points, the size of the feeders for the distribution points away from the transformer must be increased over what would otherwise be needed.

Since the secondary network has six sets of transformers fairly equally spaced over the building area, it is obvious that voltage regulation will

be approximately the same at any given point in the plant. This is due to the fact that low-voltage, high-current feeders are eliminated and power is distributed at high voltage, with practically no line drop.

Short-Circuit Current. The short-circuit current that can be obtained with the radial distribution system will vary greatly, depending upon the point at which the short circuit occurs. Factors that make the voltage regulation different at different points also cause the short-circuit current to change.

A short-circuit study of the radial distribution system shown in Figure 1 has been made and the results are shown in Figure 3. The short-circuit current that can be obtained on the main bus of this system is limited only by the impedance of the main transformer bank plus that of the system feeding it. Normal impedance of a transformer of this size is 6 percent and the short-circuit current on the main bus will be approximately 55,000 amperes on the basis of a metal-to-metal, three-phase short circuit.

The short-circuit current that will be obtained at the various distribution buses will be decreased because of the impedance of the cables feeding them. From Figure 3 it will be seen that the short-circuit current at distribution buses *1* and *2* is about 41,000 amperes; at buses *3* and *4*, 26,000 amperes; and at buses *5* and *6*, 19,000 amperes. The three-phase short-circuit current along any branch circuit will depend upon the distance away from the distribution point and on the size of the cable. Figure 3 indicates the values of these currents at different distances from the distribution buses, for sizes 4/0 and 1/0 three-conductor cable.

From the data shown in Figure 3 the approximate value of short-circuit current can be obtained for any spot in the plant. For example, with a 1/0 cable the short-circuit current at a distance of 200 feet from distribution buses *5* and *6* is reduced to approximately 7,500 amperes.

It is evident that there is a wide variation in the short-circuit currents that may be expected, and, if each controller is to be provided with a suitable circuit-interrupting device, each point must be checked to make certain that the control will be satisfactory.

A similar study has been made for the network distribution system shown in Figure 2, with the results that Figure 4 shows.

With the network system the short-circuit current at any given point on the secondary grid is considerably lower than on a corresponding radial network, due to the fact that the transformers are much smaller and there is a secondary impedance of the connecting cables between the transformers. Our studies show that with transformers having 5 percent reactance the maximum short-circuit current that will be obtained on any one of the distribution buses is approximately 19,000 amperes. Also, since it has been assumed that the distribution buses have been equally spaced over the plant, the short-circuit current will be the same at any one.

The only variation in short-circuit current that will be experienced on the network system will depend upon the size of the cable and the distance of the short circuits from the distribution point. Values of short-circuit current have been plotted in Fgure 4 for two sizes of cables. These curves indicate that the value of short-circuit current will vary from 19,000 amperes at the distribution bus down to 8,000 amperes with 1/0 cable, 200 feet away.

These data indicate that the maximum short-circuit current that can be experienced on the network system is less than half that which may be experienced on the radial system. On the other hand, the minimum short-circuit current that will be obtained is considerably higher.

The main advantage of the network system in this respect is that the range in short-circuit currents is fairly small

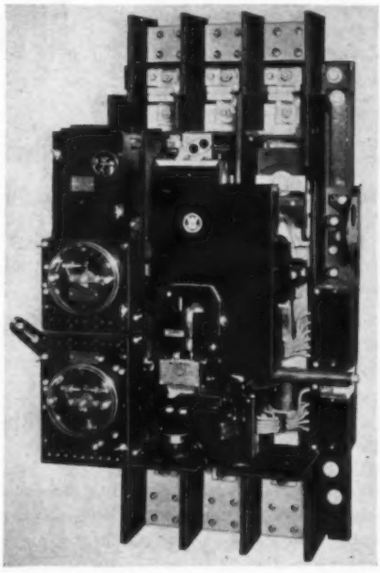


Figure 5. The network protector, a special electrically operated circuit breaker with suitable relays, insures service when faults occur in transformers or primary feeders

and a standard practice can be adopted for the circuit-protecting devices with the assurance that they will be satisfactory for any part of the plant and that control apparatus can be moved from one part to the other with safety.

It is probably recognized in many plants that it is possible to have short circuits of several thousand amperes under the worst conditions; it is also probably true that most plants never have had such a short circuit. The general policy is to install suitable feeder and distribution breakers that will open any short circuit likely to occur anywhere in the system, and hope that there will never be a bad short inside a control box.

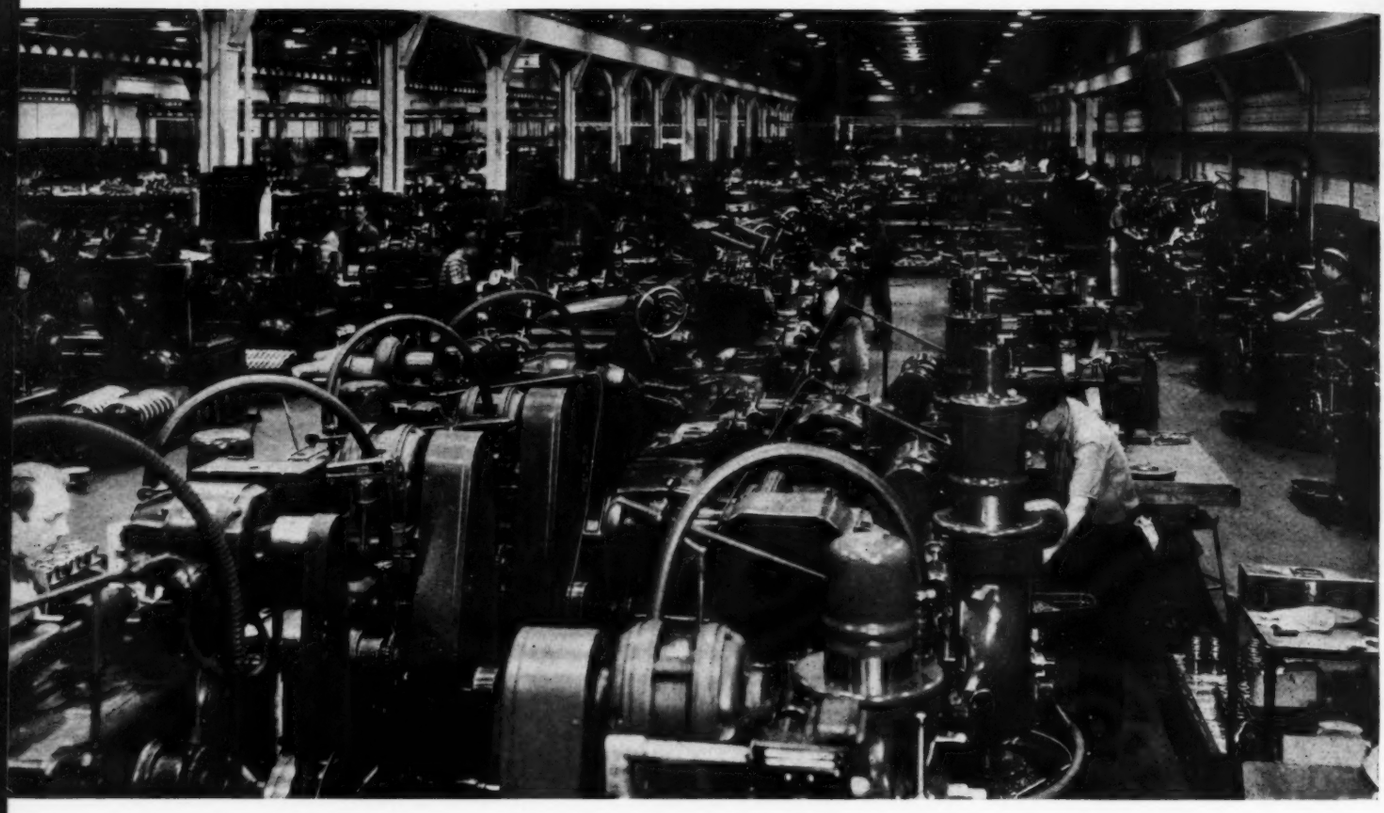
There is no doubt that the type of control bought for the average machine tool would be destroyed in the event of such a short circuit. From the economic standpoint it is undoubtedly desirable to buy a new control if a short circuit does occur, rather than buy a control that has contactors and disconnecting breakers of sufficient capacity to handle the fault.

Probably the most serious problem is the chance of injury to the operator or the maintenance man. In view of the modern practice of inclosing all controls either inside the machine tool or in their own cabinets, the chances of personal injury are rather remote.

Cost. The cost of a radial system as compared to a network system will vary for every plant considered. In general, it can be said that if the main object is to provide a system that is as simple as can be designed to get power around to the different points, in practically every instance the radial system will be cheaper. On the other hand, if an attempt is made to provide for future expansion, or to alter the radial system in an effort to provide greater reliability, then it is usually cheaper to provide those features by means of the network layout.

Considering the typical layouts shown in Figures 1 and 2 it is estimated that the network system can be installed for approximately the same cost as the radial distribution system.

If the question arises as to why the network is not more commonly used, the answer is that it is a new idea to meet new conditions, and large-scale expansion has until recently been limited. First, its economical use depends on load concentration and type of service. Also, the electrical apparatus is new and not so commonly understood as that used in the radial system.



Placing production machines as close to each other as possible certainly does not help to simplify factory maintenance problems

Maintenance Goes On Day and Night

Changes in size mean changes in method. When Warner and Swasey went from one-shift production to three, many previous maintenance procedures were discarded in favor of better ways. Now maintenance itself works three shifts, six days a week

SIDNEY W. WATKINS
Electrical Maintenance Department
Warner and Swasey Company
Cleveland

IN CHANGING OVER from one-shift to three-shift production, great care has been taken not to lower our maintenance standards. No corners have been cut and no details neglected.

On the contrary, the necessity for solving many pressing problems, some of them urgent and none of them easy, has caused us to study every facility and every method with unusual care.

We have tried many experiments, and we have created innovations previously unheard of in our plant.

We have been forced to find better and quicker ways to do things; to seek new resources inside and outside the plant; to call upon our older and more experienced employees to take over new responsibilities. In fact we have been called upon and have called upon our helpers to "do the things that can't be done." At all times, however, we have endeavored to keep before us the time-honored slogan of maintenance men—"maximum efficiency with minimum waste."

Since 1939 we have increased our total floor space 110,000 square feet. Three stages have marked the erection of new buildings:

First, we had a moderate expansion in the early part of 1940, caused by the normal increase in demand for our products; second, in the middle of the year, we doubled original additions; and third, in the last part of 1940, with the

defense program bringing pressure, we again doubled the additions made since the early part of the year, installing a proportional amount of machinery for direct operations, plus materials handling equipment, plus transmission lines and all other accessories of manufacturing in a metal-working industry.

Every available foot of new construction is now occupied by factory equipment. Some of the old factory space has been taken over for engineering work and office departments. At least 95 percent of the machines have been moved once, and many of them have been moved several times as we revamped department after department, time after time.

Every productive machine in our plant now works 24 hours a day, 6 days a week. This program has been followed for more than a year. That leaves 24 hours in each week, aside from holidays and days when part of a department may be idle temporarily because it is ahead of schedule. In those 24 hours maintenance workers must perform their task, must see that no piece of equipment is idle because it is not in working condition.

Maintenance men pile into a department in a hurry the moment that department's machines are idle. Or perhaps they go just into a group of machines in a production center.

Something New

Constant servicing goes on while the machines are in operation, without interfering with the operator. This is something entirely new in our plant.

The change from one shift to three shifts was made gradually. We hired as many experienced men as we could find, then we began to train inexperienced men during the daytime hours, with the understanding that they were to go on a night shift when they were ready to handle the job.

When we had a sufficient force, we started the second shift. Then as the trainees began to come through, we opened up first one department, then another and another, on the third shift. In this way we gradually reached the point where we could count on three full shifts.

We have many kinds of training going on right now. It has become an established part of our work to keep on training men for drop-outs, to take the places of men who are called in the draft, or who are unable to keep up the pace, either because they lack aptitude for the work, or for other reasons.

Our plan B.D. (Before Defense) was to have each man capable of doing as many different jobs as possible, rather than specializing. Now we have just the opposite. Every man has a special job, and he does nothing else except in an emergency.

One crew of maintenance men looks after the cranes; another, the elevators; another, the electric trucks; still another, the lighting system. Another group specializes in keeping up the expansion of the power system to meet the demands made on it in every section of the plant.

This change did not take place all at once, of course, and not without a great deal of training, retraining, and hiring of new men.

Every maintenance man does one job better than any other—our idea has been to let him specialize in that work, and to train inexperienced men to assist him. In other words, groups of specialists were created, with an experienced man as the nucleus of each group.

With approximately double the equipment we had in 1936, naturally the question of repairs to machinery and equipment has been a problem which has called for more and more resourcefulness, especially since the urgency of defense work has made it mandatory to keep every machine and every materials handling unit in operation all the time.

Formerly, on the one-shift basis, there was no repair problem to speak of. When the men stopped work for the day, the repair crews moved in.

There is no stopping now. Lunch hours are staggered so that our crews can go into sections for quick repairs. The plan now in operation is to take advantage of every opportunity—Sundays, holidays, and when men are sent home for half-days because they are ahead of schedule.

We also call in help from outside, or send out light equipment for repair. Sheet metal work, rewinding motors, and other electrical work, is done by outside shops under our direction.

Artificial lights burn continuously day and night. Lamps and reflectors must be kept clean, and bulbs or units changed when the foot-candle meter shows too little light

Our former practice was to have each operator keep his own machine in good working condition. This meant oiling, greasing, and cleaning. That has all been changed.

Different operators had different ideas about the kind and the amount of oil their machines required. Each machine was handled as an individual unit. Today all our lubrication is standardized. Only specialists lubricate the machines. Each department has its own oiler, for instance, and he knows every machine in the department, just what type of oil and grease it requires, and where to apply it.

We now have central control of lubri-

cation. Each oiler receives printed instructions about the machines in his section.

Part of the oiling is done while the machine is in operation, some of it during the setting-up period, and the greasing is done when an opportunity offers—on Sundays, holidays, and occasional off-days. A 5- to 10-min. period is allowed an operator before going off the last shift on Saturday to clean up his machine.

We have no burned-out motors, nor failures of machines through lack of lubrication, since this system was started; we did have some of these headaches when the operator was responsible for the lubrication of his own machine.

This innovation, which was the result of increased pressure for more and more production, releases the operator from every duty not directly concerned with the operation of his machine.

Artificial lights are on throughout the plant 24 hours each day, because even on the brightest days natural light does not provide our operators with the type of illumination that enables them to read the dials accurately.

The improvement in lighting has reduced the number of accidents, made it possible for the operators to do more efficient work, reduced eyestrain, and improved morale by making the surroundings cheerful and healthful.

The night forces especially have benefited by the lighting installation, which has reduced defective work and spoilage.

Supplementing the lighting phase of maintenance is the question of wall and ceiling background colors. In our plant we have used a white enamel, and it has proved satisfactory in reflecting light on the work.

Lamps and reflectors are kept clean, and when the foot-candle meter shows a diminution of lumen output, we immediately search out the trouble and change bulbs, or replace entire units if necessary, as we consider lighting a most important adjunct to efficiency in precision operations.

We have experienced no damage to these lamps from the vibration of machinery.

White walls and ceilings need care. To free company maintenance men for more important jobs, outside workers are called in to do the necessary washing and painting

One of the new departures which has proved advantageous in the upkeep of the plant, has been bringing in outside workers to wash and paint walls, clean lamps, and take over jobs at which they are expert, and which our men can now eliminate from their worries; yet these jobs are important in maintaining healthful, sanitary, and psychologically cheerful surroundings for the people who work in our plant.

Our men are trained to keep their working equipment in good order and to send tools for sharpening and repair to departments specially equipped for this work. Here again we eliminated time-consuming tasks and relieved our workers of duties which can be better done by others.

The practice of bringing in outside specialists has permitted our building maintenance men to concentrate on plant protection, such as safety and fire prevention, the sprinkler system, valves, pumps, hydrants, extinguishers, steam pipes, windows, entrances and exits, firedoors, and any hazards which might cause injury to workmen.

In 1936, together with other phases of our reorganization of plant facilities, an entirely new radial electrical distribution system was gradually installed without interrupting production. Several important changes were instituted. The same sized transmission lines were laid throughout, instead of tapering the size of conductors downward toward the ends.

In 1937 the business took up most of the power we could apply. At that time, and several times since, the local utility company has added incoming lines, until we now have four times the power capacity available in 1936. We have never had to shut down a machine for lack of power.

A True Blessing

Warner & Swasey Company was one of the few plants in the country to overhaul its power system completely during the depression. Labor and materials were then favorably priced and easily obtainable. Now it is a different story, and it goes without saying that costly installations, which seemed extravagant under the conditions existing five years ago, have proved a true blessing under the terrific urgency of 1941. And still more extensions can be installed, if necessary, without any radical changes in the distribution system. Much of this work also has been done since July 1939.

The greatly increased capacity of the incoming power lines, together with our new distribution system, guarantees us flexibility in changing locations of equipment; provision for applying increased loads when and where required; and avoidance of excessive voltage drop.

The distribution system, as completely revamped in 1939 and 1940, assures us of the delivery of adequate power to the point of application on any machine in the plant.

In the installation of machines, great care was taken to see that every machine was equipped with a motor or motors of the proper rating.

Some of our machines have as many as ten motors, and we use both direct and alternating current. In some instances both are used in one machine, which provides manifold problems of maintenance.

Controls Must Be Well Protected

Against dust, fumes, and various harmful influences to be found in many industrial plants. Here's how to protect them from what NEMA calls unusual service conditions

J. H. HOPPER
Industrial Control Engineering Department
General Electric Company
Schenectady

UNUSUAL CONDITIONS, such as high altitude, exposure to certain types of dust, or atmospheric peculiarities, are likely to have adverse effects on control equipment. To provide proper protection it is often necessary to install controllers that have been specially designed and constructed.

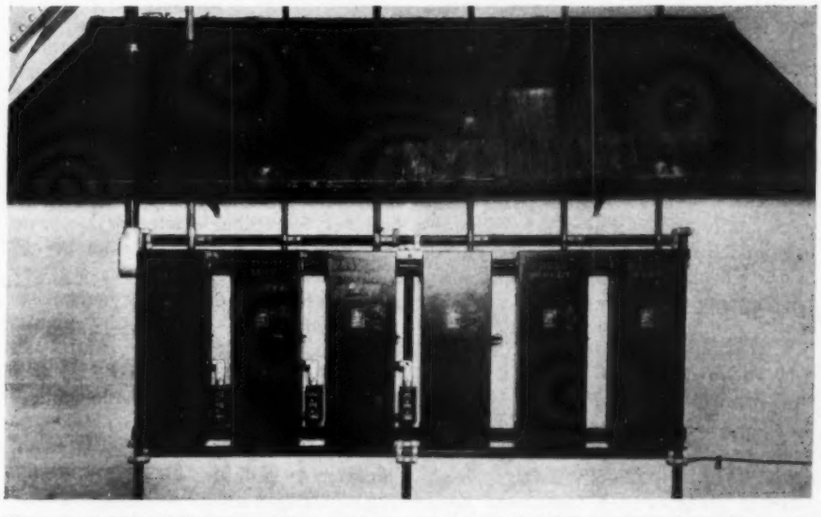
In the "Standards for Industrial Control," published by NEMA, attention is called to the most important of these unusual service conditions, which are listed in the box. How controls can be made to operate satisfactorily under these conditions will be discussed in this and a succeeding article.

1. *Ambient Temperatures above 40 Degrees C. (104 Degrees F.)*—Almost any manufacturing establishment will have some locations which are infernally hot. Fortunately these areas are usually of limited extent, so that it is often possible to locate control equipment away from these hot spots. Wherever this can be done it is to be preferred to the use of special control designed to withstand high ambient temperatures. It should be noted, however, that thermal overload relay elements are normally selected on the assumption that motor and control will be subjected to substantially the same ambient temperature. If this is not so, the difference between ambient temperatures should be taken into consideration in selecting the proper thermal overload relay elements. Of course, this difference in ambient temperatures should be approximately constant for best results.

Locations in or near which ambient temperatures above 40 degrees Centigrade are sometimes encountered (particularly in summer) are: boiler rooms, bakeries, industrial ovens or furnaces for baking or annealing processes, numerous steel mill locations, and literally hundreds of other industrial processes where high temperatures are used in processing or appear as a byproduct of certain processes. Also, in warm climates direct exposure to the rays of the summer sun is usually equivalent to raising the ambient above 40 degrees Centigrade (104 degrees Fahrenheit).

SEVERE SERVICE CONDITIONS

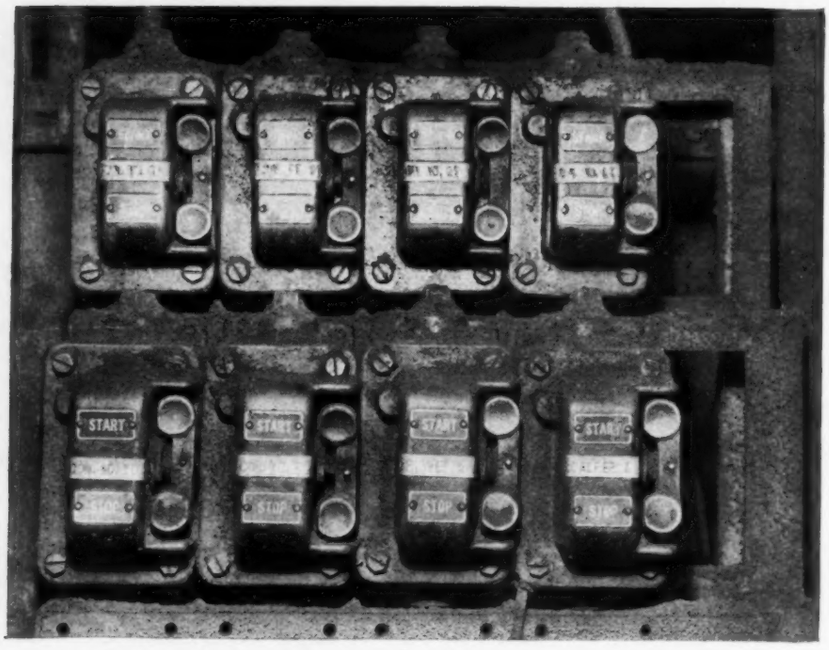
1. Ambient temperatures above 40 degrees Centigrade (104 degrees Fahrenheit)
2. Altitudes above 6,000 feet
3. Exposure to damaging fumes
4. Operation in damp places
5. Exposure to excessive dust
6. Exposure to abrasive dust
7. Exposure to steam
8. Exposure to excess oil vapor
9. Exposure to salt air
10. Exposure to vibration, shock, or tilting
11. Exposure to explosive dust or explosive gases
12. Exposure to the weather or dripping water



Here watertight inclosures and a canopy protect against dampness and condensation

2. *Altitudes Above 6,000 Feet*—Probably only an infinitesimal percentage of all motors and control operate in such high altitudes. When they do, their internal losses (heating) are unchanged, but the rate of cooling by convection is less than normal because of the rarified air. Therefore, the equipment operates at a higher temperature rise. It is general practice to derate standard equipment, or to furnish special equipment for these applications.

3. *Exposure to Damaging Fumes*—In chemical works, oil refineries, tanneries, sewage disposal plants, paper mills,



There's much abrasive dust around a coke plant, which calls for dust-tight pushbuttons

fertilizer plants, smelters, and many others, certain gases are liberated which are bad actors. They may cause severe corrosion of metals, or failure of insulating parts, or both. They usually do their dirty work much faster in the presence of high atmospheric moisture content. Ordinary protective coatings are not adequate against these active fumes; therefore, more heroic methods have been necessary for locations where these fumes exist in sufficient concentration to cause serious trouble.

For many applications successful protection has been afforded by tightly gasketed inclosures. However, it is almost impossible to make an inclosure so tight that it will not "breathe" to a certain extent under conditions of changing temperature. Therefore, where damaging fumes are extremely bad, the complete controller is sometimes submerged in oil for protection against corrosion. This is most commonly done in so-called "hazardous locations," such as oil refineries and chemical plants, where a suitable oil-immersed construction takes care of explosion hazard and protects against corrosion at the same time. The oil-immersed construction also has an economic advantage where voltages above 600 volts are involved.

Sometimes it is advantageous to segregate most of the control equipment for a certain area inside a specially built control room that is pressure-ventilated with clean air. The air may be piped in from a distance or decontaminated locally. This method has the advantage of employing standard general-purpose types of control, which are less expensive in first cost and also much easier and less costly to inspect and service.

4. *Operation in Damp Places*—In mines, tunnels, subways, cellars, laundries, dyeing plants, textile mills, as well as in many tropical climates, the moisture content of the air is usually high, sometimes approaching the saturation point. This condition greatly accelerates the natural tendency of metals to corrode, especially if other corrosive agents happen to be present in addition to oxygen and moisture. Moisture in any form is also the arch foe of insulating materials. It is, therefore, sometimes advisable to use special-purpose control for operation in damp places.

Special treatments are sometimes given coils and insulating parts, and occasionally it is necessary to provide additional protection for metallic parts. In many instances the necessary dryness can be maintained by adding a small heater within the controller inclosure. It is only necessary to keep the controller a few degrees above ambient temperature to prevent moisture condensation, which is a common cause of insulation failure. For tropical climates, the additional problem of high ambient temperatures sometimes adds further complications.

5. *Exposure to Excessive Dust*—Under this heading will be considered only non-abrasive, non-explosive dust conditions, since abrasive and explosive dusts are specifically discussed under other headings. This is rather a theoretical classification, because most dusts are either abrasive or highly inflammable. However, excessive dust can interfere with the correct operation of control without possessing either of these two dangerous properties. It can clog and interfere with the operation of moving parts. By collecting on contact surfaces it may cause a failure to make contact. It can cause overheating by covering the control with a heavy insulating blanket of dust. Therefore, for excessive dust conditions, control must be inclosed so that dust can be effectively excluded. The size and type of inclosures can vary from a pushbutton inclosure to specially built control rooms.

6. *Exposure to Gritty or Abrasive Dust*—This type of dust usually has all the bad features of ordinary dust, in addition to some of its own. It can cause binding or sticking of moving parts, or, by its abrasive action on friction surfaces, it can greatly shorten normal mechanical life. It can work into coils and cause insulation failures or short-circuited turns. This type of dust sometimes causes trouble even when present in relatively small amounts. Abrasive dust conditions are often found in mines, coal and ore handling equipment, quarries, cement mills, rock crushers, and electric shovels, to mention only a few instances. Protective measures against this type of dust are the same as those already mentioned except that the inclosures should be perhaps more effective in completely excluding dust.

7. *Exposure to Steam*—The term "steam" implies a condition of high temperature and considerable water vapor. It is almost never necessary for control equipment to be exposed to temperatures incident to so-called "live steam." Therefore, there is practically no control available for operation under such conditions. There are, however, a number of steamy locations in which it is sometimes necessary to locate control equipment. These places may be found in laundries, canneries, paper mills, food-processing plants, and the like. Standard control in watertight inclosures is usually applied successfully in such locations, unless the ambient temperature is above 40 degrees Centigrade, when more special equipment suitable for operation in higher temperatures is required.

(To be continued)

Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the ordinary maintenance accomplishments. Accepted articles will be paid for

BUILDING, SERVICES AND MAINTENANCE

Now Get Twice the Use From Hacksaw Blades

J. J. REICH, *Reich-Huntington Iron Works, Huntington, W. Va.*

On a run of work involving small bar sections of steel, it was noticed that the power hacksaw blades were wearing out only in the rather small portion that came in contact with the work. Because most power hacksaws have, of necessity, a stroke considerably shorter than the blade length, the discarded saw blades were only partly used up.

To correct this condition, after the saw had become dull in one place, we moved the vise back from the position in which it usually was placed, thus bringing the work into contact with a portion of the blade which heretofore was unused. We estimate that we are now getting twice the use from our power hacksaw blades that we formerly did. In fact, we were able to withdraw from salvage some blades that had been discarded, and were being held only for their high-speed scrap value.

Where a fixed vise is used a block can be placed ahead of the work to secure the same result as that obtained with the slidable vise.

•

New Welding Inclosures Speed Work

SOURCE
Reliance Electric & Engineering Company, Cleveland

Plant expansion and relocation of several production departments made it possible to introduce some improvements in the facilities afforded the men who handle the welding operations.

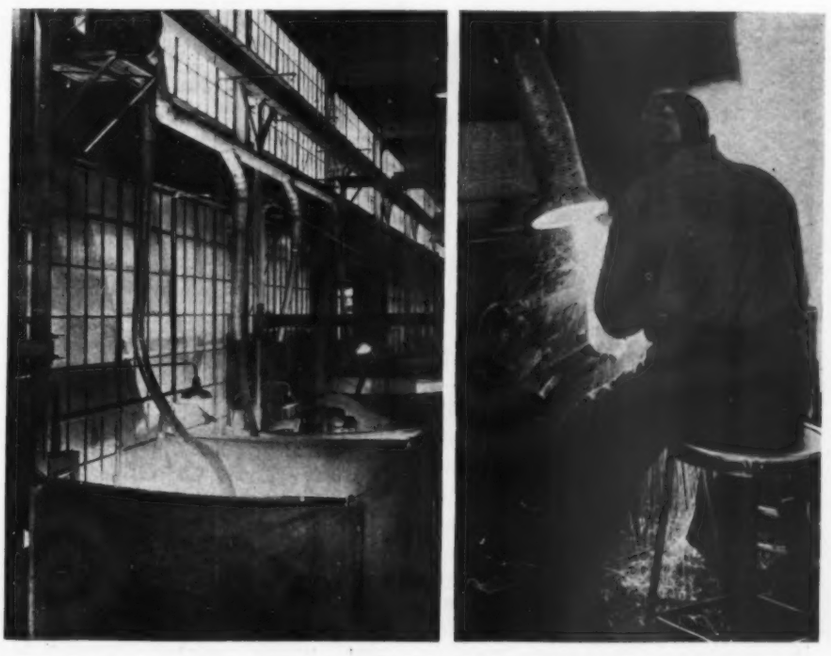
The first improvement was the introduction of canvas inclosures for the welding booths. The only rigid part of the inclosure now is the plant wall against which all the booths are located. Three sides of each booth make use of regular brown welding canvas, hung by the corners from standard safety zone stanchions, 6 feet, 2 inches in height, with a base 125 pounds in weight. Each stanchion has bolted to it a light sheet-steel strip which projects approximately 12 inches on either side of the upright to prevent injurious light rays from passing through the curtain junctions, and to provide a snug inclosure of each booth. The stanchions used at the corners of the booths have two of these light sheet-steel strips bolted at right angles to each other to form tight corners.

Eyelets in the top corners of each section of welding canvas permit fastening it securely to hooks in the stanchion tops. This method of holding the inclosures in place is important because it eliminates wires or pipe supports across the tops of the booths, permitting much greater freedom and safety in depositing work from overhead cranes. Making the canvas its own means of suspension leaves nothing solid to run into or tip over in bringing work into or out of a booth. The hook and eyelet arrangement makes it possible to take down or put up the curtains quickly and easily.

The canvas is of standardized size (10 feet wide by 5 feet high) to facilitate its interchange with other departments, where similar inclosures are used around engine lathes as protection against flying chips, around spot welding operations to guard against flying sparks, and around other work to corral flying nails or metal particles that might endanger passers-by.

Ordinarily the welding booths are kept to 10 by 10 feet. This area has been found large enough for the handling of regular work. However, should the size of the work necessitate it, spare curtains and stanchions are put up to make the booth inclosure 10 by 20 feet, or larger, in any desired combination of 10-ft. additions. All of the interior of a booth is made available as working space; bulk supplies are kept outside the booths to decrease the hazard of an operator's bumping into or stumbling over them inside.

The second improvement made possible by the new location of the welding booths, is the method of ventilation. Basis of the system is the use of a low volume of air at a fairly high velocity—545 cubic feet of air per minute per intake at approximately 4-in. static pressure. A 15-ft. length of flexible



It's easier to move equipment, and ventilation is better, with these welding booths

tubing, 5 inches in diameter, and individually counterweighted with light airplane cable, is dropped into each booth from an overhead main ventilating line serving all welding stations.

Each tube has a bell end (screened since one of the welders lost his cap up one of the pipes) and is just the right length to be readily maneuverable around and above the work. No tube is long enough to touch the floor.

Where especially large pieces of equipment are being welded and must be handled at some distance from the regular booth enclosure, 5-ft. extensions of flexible tube are provided which can be added to any one of the regular lines.

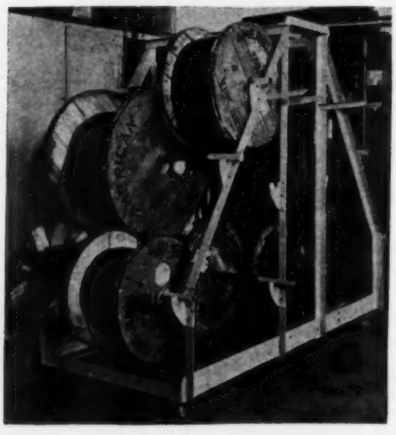
Third improvement for the new welding booths is the location of two jib cranes over the line of booths, so placed that they can serve a wide area in picking up and depositing work inside any one of the booths with a minimum of interference to operations already in progress.

•

Reel Rack Facilitates Rope Storage

SOURCE
Buick Motor Company, Flint, Mich.

In every large manufacturing plant there is need for several different sizes and constructions of wire rope. For one type of rope only comparatively short lengths are needed; whereas for other constructions an entire reel should be available. This makes quite a problem



of rope storage. The accompanying illustration shows how it was solved at the Buick Motor Company's plant in Flint, Mich.

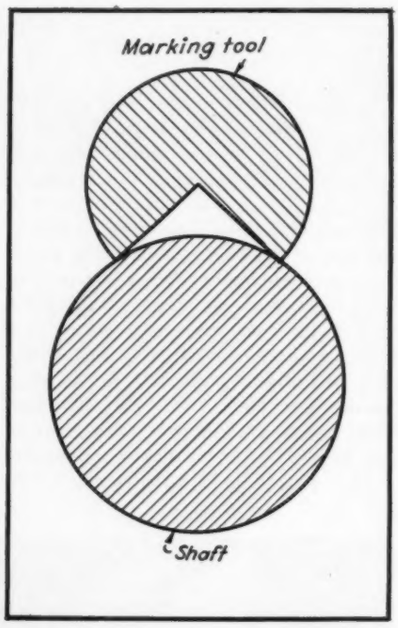
A rack, raised on castors for portability, carries nine or ten reels of rope in a surprisingly small space. Stored in this way the wire rope can be wheeled from machine to machine and lengths cut as desired. This arrangement also has the advantage of making it impossible for workmen to pull a rope from its reel in such a way as to cause it to kink.

•

Tool Saves Time When Laying Out Keyways

THEODORE OSHINSLY, *Brooklyn, N. Y.*

The cylindrical marking tool shown in the illustration will be found very handy when it is necessary to scribe a straight line on a shaft, piece of pipe, or other round object. Laying out keyways and sectional lines are among the



operations in which it will be a time saver.

As will be seen, the tool is merely a piece of ¾-in. drill rod about 6 inches long, milled as indicated. It is advisable to harden the rod, in order to keep the edges from becoming battered.

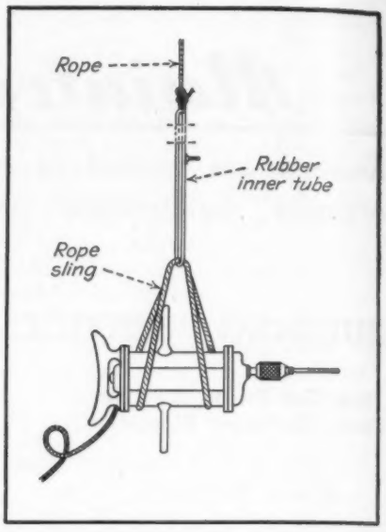
To use, the tool is held firmly against the shaft with the fingers while the line is scribed.

•

Inner Tube Takes Weight of Heavy Tools Off Operator

H. C. SLEMAN, *New York*

Handling heavy drills and other portable tools is often difficult, especially when they must be used above the floor level. Unless supported in some way their weight imposes considerable strain on the operator, thus increasing



the time required to do the job. Also, the quality of the work suffers because it is almost impossible to secure anything like real accuracy in keeping a heavy, lively drill in alignment.

Supporting such tools by ropes or chains is not difficult, but the inherent lack of flexibility in such supports results in the waste of a good deal of time and effort in getting the tool into position. A practical method of overcoming this limitation is to support the tool by an ordinary automobile inner tube, which in turn is suspended by a rope overhead, as shown. The elasticity of the tube allows free movement of the tool within a fairly large circle around the work, making it easier for the operator and reducing the time required.

•

Gravity feed on light press work upped production 59 per cent in one case.

•

Sawdust Saves Trouble When Installing Floor Drains

S. H. COLEMAN, *Roanoke, Va.*

Special care is necessary when installing floor drainage fittings, prior to pouring concrete slabs. These devices must be leveled, aligned with the building walls, and placed at an elevation far enough below the finished floor to insure drainage from every point on the surface. They must also be protected against the possibility of concrete entering the drain and its connecting piping. Failure to take such precautions may result in considerable unnecessary expense incidental to cleaning the fitting and trap.

The time-honored method of avoiding stoppages of this kind is to insert a plug of some sort in the pipe connection, and then fill the floor fitting with

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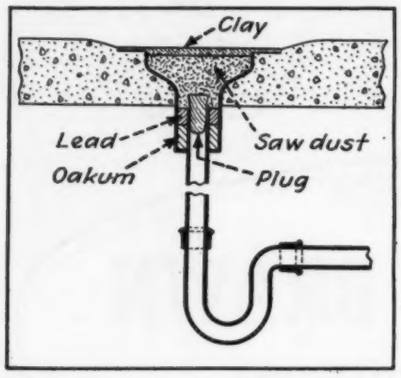


clay to a point flush with the floor level. This procedure has one great disadvantage, however, in that when the plug is removed some of the clay may enter the piping and interfere with the flow of water through the trap.

Using sawdust topped with a thin layer of clay as a filling medium, as shown in the drawing, instead of an all clay filler, will practically eliminate danger of the trap becoming plugged. Sawdust, unlike clay which is heavier than water, will remain in suspension, and is readily carried along by the flow of liquid.

ELECTRICAL TRANSMISSION and UTILIZATION

It's No Wonder the Motor Smoked

H. E. STAFFORD, *Port Arthur, Ont., Canada*

A small gas fan in an acid plant was originally driven at a speed of 1,000 revolutions per minute by a 10-hp., 600-r.p.m., three-phase induction motor. It was found, however, that the fan did not supply the necessary volume of gas when it was desired to increase the production of the plant.

Someone estimated that in order to deliver the required volume of gas to the towers the fan would have to be driven at a speed of 2,000 revolutions per minute. The fan was equipped with a 4-in. pulley and since the full-load speed of the motor was 580 revolutions per minute it was calculated that a motor pulley $(2{,}000 \times 4) \div 580 = 13.79$ inches in diameter was needed. Accordingly a 14-in. pulley, the nearest available size, was fitted to the motor shaft.

Right here the master mechanic should have known that something was wrong, even if he did not know anything about the horsepower of fans, because the pulley was only 6 inches smaller in diameter than the motor frame.

When a belt was put on the pulleys and power applied to the motor only one thing could happen—the belt came off. Then the belt was almost totally inclosed from pulley to pulley with pieces of 2 x 4 driven into the ground, and tightened until it fairly sang.

This time the belt could not come off and the fan reached a speed of 1,300 revolutions per minute, the motor speed being $(1{,}300 \times 4) \div 14 = 371$ revolutions per minute.

In approximately 20 seconds the motor began to smoke and was immediately shut down. After a consultation it was decided to call in outside help.

It did not take long, of course, to find out what was wrong and show those interested why the application was impossible. Seemingly none of the men knew that the power required to drive a fan of this type increases as the cube of the speed. The situation, then, was as follows:

Original speed of fan, 1,000 r.p.m.
Speed on test, 1,300 r.p.m.
Horsepower at original speed, 10

Then the horsepower required for an increase of 300 revolutions per minute is $(1{,}300^3 \times 10) \div 1{,}000^3 = 21.97$. Therefore, to drive the fan at 2,000 revolutions per minute would require $(2{,}000^3 \times 10) \div 1{,}000^3 = 80$ horsepower.

•

These D.C. Motor Troubles Were Puzzling

LIONEL A. HUNT, *Assistant Factory Superintendent, English Electric Company of Canada, Ltd., St. Catharines, Ont., Canada*

An order was received to remove the armature of a d.c. motor and turn and undercut the commutator. The owner complained that one brush had always sparked, and that the commutator required turning periodically. Also, that the brushes in one holder soon wore down.

A test revealed that one series coil of this four-pole, compound-wound motor was reversed, and apparently always had been. Hence the disturbance of the field at the one polepiece had been the cause of all the trouble.

On another occasion we received a complaint that a d.c. shunt-wound, interpole motor would race and run away on the slightest provocation. It had been operating for two years and was belted to a lineshaft driving buffing wheels. The trouble had developed suddenly and was very annoying because when a large piece was being buffed the motor speed would rise dangerously and the whole lineshaft would whip so violently that the operators were afraid it would tear loose. This action was puzzling because the motor had no series field.

A check-up eventually revealed that the brushes had been carried slightly forward by the armature rotation, due to the rocker arm working loose. This movement had brought the active armature coils too far forward, to the point where the south interpole flux tended to wipe out the north main pole flux. The resulting field therefore became weaker as the interpole became stronger, and caused the motor to run away on increase in load.

It was, of course, a simple matter to correct the trouble by moving the brushes back to their proper position.

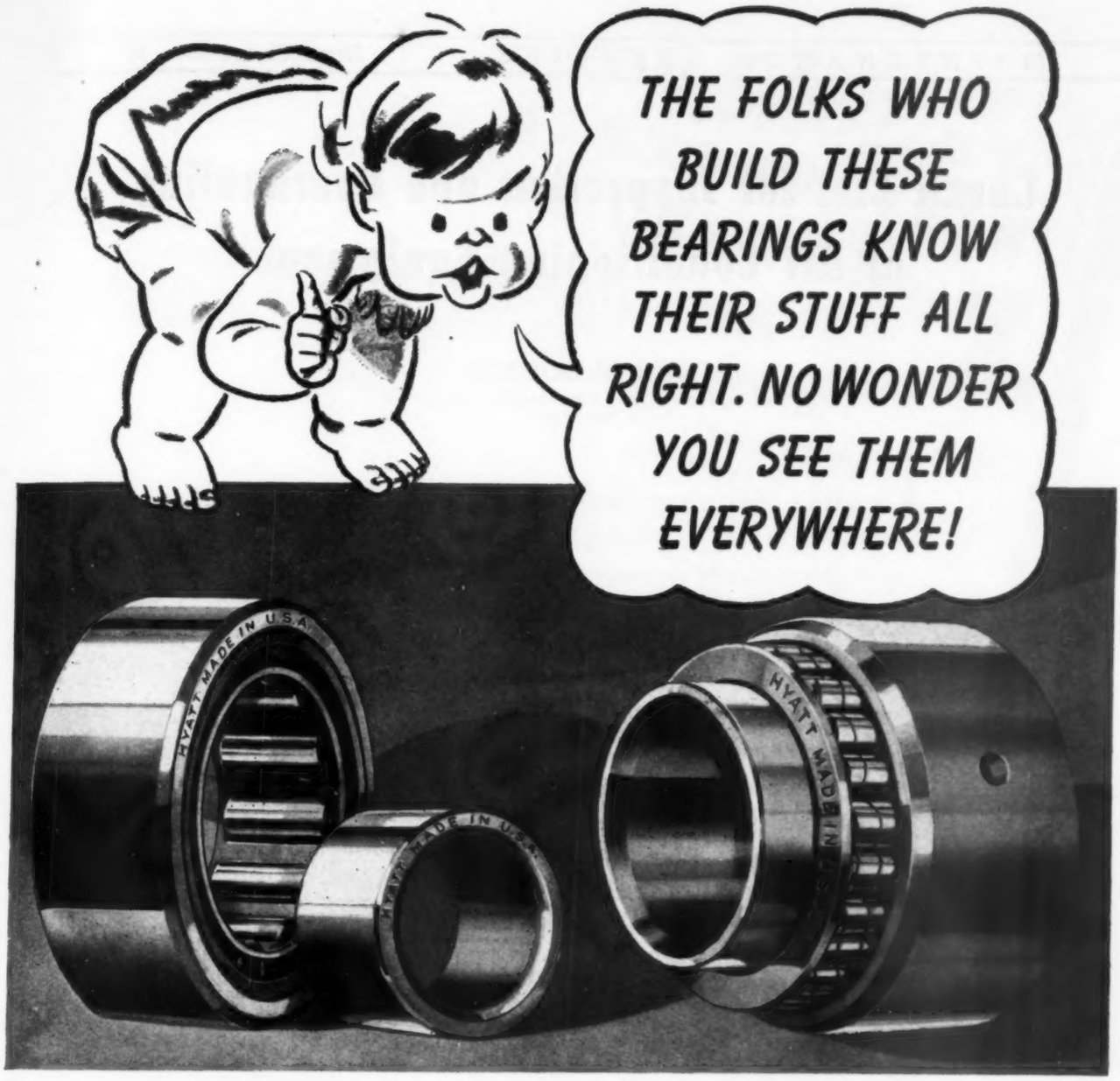
•

Open Housing Prolongs Life of Switches

GILBERT LINDGREN, *Electrical Foreman, Hudson Valley Fuel Corporation, Troy, N. Y.*

When it is necessary to mount switches out of doors the three-sided shelter shown in the illustration will add years to their life. It is made of fairly heavy sheet metal, and is kept well painted. The top is embedded in the brick wall about 1 inch.

It will be noticed that the concrete has been brought up around the conduit for about 12 inches above ground level. This method of installation also adds considerably to the life of underground conduits. The concrete should be sloped at the top, of course, so that water will immediately drain off.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QUIET

Check List for Inspection and Overhauling of Air Conditioning Equipment

W. J. McDONALD
Buensod-Stacey Air Conditioning, Incorporated
New York

AIR CONDITIONING EQUIPMENT requires periodic inspection and overhauling to keep it operating at its highest efficiency. Usually any necessary repairs are made during the spring months, between winter heating and summer cooling requirements.

This year ever-increasing production demands of the national defense program make it imperative to anticipate possible shutdowns caused by failure of air conditioning equipment.

All equipment should be most carefully checked. It is equally important to see that a stock of necessary supplies and repair parts and materials is on hand, for use if the need arises.

The check list below has been drawn up by following the path of air through a medium-sized industrial system. Spray or surface type apparatus with steam heat and Freon-12 refrigeration has been assumed. Any painting mentioned is meant for protection.

Outside Air Intake

1. Check openings for obstructions restricting air flow, location of other exhausts and reliefs, condition of louvres, screens, cowls, or hoods, flashing if any.

2. Are screens and protective grilles clean and securely attached? Do they need painting?

Volume Dampers

1. Do dampers move freely between full open and closed positions?

2. Do they need lubrication?

3. Check damper operator and linkage for cleanliness, lubrication, and loose connections.

Tempering Coils

1. Is coil surface clean? Check for leaks in coils, piping, valve packing, and so forth.

2. Check drains, drips, traps, etc.

Mixing Chamber

1. Is chamber clean, and tight?

2. Does it need painting?

Air Filters

A. Renewable or Throwaway Type

1. Are cells clean? Are refills or replacements necessary?

2. Does frame need cleaning and painting?

B. Continuous Type

1. Are filter and bath clean?

2. Check condition of filter surfaces and for bypassing of air through broken sections or around frame.

3. Do frame or tanks need cleaning and painting?

4. Check operating mechanism for wear and loose parts.

5. Check operating motor and switches for cleanliness, good contacts, and loose connections.

6. Obtain replacements for any worn or doubtful parts.

C. Electrostatic Type

1. Are inlet screens and collector plates clean?

2. Check for broken ionizer wires.

3. Check power pack by means of signal devices provided.

4. Check calking compound seal around cells for tightness.

5. Check tightness of access doors.

(*Continued on page 104*)

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Check List for Inspection and Overhauling of Air Conditioning Equipment

(*Continued from page 102*)

Entrance Louvres or Baffles

1. Check condition of baffles.
2. Are replacements necessary?
3. Are they clean?
4. Do they need painting?

Casing

1. Check for corrosion and rusting.
2. Are casing and connections air-tight?
3. Do access doors close tightly?
4. Are interior lights (if any) in working order?
5. Is casing clean?
6. Does it need painting?

Tank or Pan

1. Drain and clean.
2. Check for corrosion and rusting.
3. Check drains and flush clear.
4. Check overflow.
5. Is overflow provided with cover to prevent loss of spray water?
6. Check piping connections for leaks.
7. Paint tank.
8. Check float valve and water level.

Spray-Type Apparatus

A. Spray Piping

1. Check for rusted or corroded piping and leaks. Note: If there is evidence of corrosion in piping, tank, casing, etc., it may be wise to investigate the advisability of water treatment methods.
2. Clean and paint piping.

B. Spray Nozzles

1. Check for erosion of nozzle body or cap and enlargement of orifice in cap.
2. Are all nozzles clean?

Surface-Type Apparatus

A. Cooling Coils

1. Is coil surface clean? (This is important for proper heat transfer).
2. Check for leaks in coils, piping, valve packing, etc.
3. Check drains and flush coils (*** For chilled water coils only).

B. Sprays (if any)

1. Check for erosion and clogging of spray orifices.
2. Check operation of valves controlling water flow.
3. Check for leaks in piping, valve packing, etc.

Eliminators

1. Check condition of eliminators.
2. Are replacements necessary?
3. Are they clean?
4. Check whether they are sealed at top, bottom, and sides to prevent by-passing of air.
5. Do they need painting?

Reheating Coils

1. Is coil surface clean?
2. Check for leaks in coils, piping, valve packing, etc.
3. Check drains, drips, traps, etc.
4. Check operation of steam regulating valve.

Fans

1. Check fan connections for air leakage. (Up to this point apparatus when operating is under fan suction and inward air leakage should be avoided.)
2. Check fan bearings and lubrication.
3. Check for loose parts, noise, etc.
4. Are fan wheel and housing clean?
5. Is painting needed?

External Parts

A. *Insulation*

1. Check for cracks, openings, air leakage, damage, etc.

B. *Motors and Starters*

1. Are air passages clean?
2. Check for worn parts, bearings, lubrication, burnt contacts, loose connections.

C. *Pumps and Piping*

1. Check packing, bearings, lubrication alignment, drains, etc. Check piping and valves for leaks.
2. Check insulation on pumps and piping.

D. *Belt Drives*

1. Check conditions of belts.
2. Check for alignment, tension, wear on sheaves.
3. Are belt guards in place and securely attached?

E. *Control Air Compressor*

1. Check operation and mechanical condition.
2. Clean air strainers.
3. Change crankcase oil.
4. Check cutout setting and relief valve.
5. Blow out any drip pockets.

(*Continued on page 106*)

Amazing Economy of
FRIGIDAIRE WATER COOLERS
due to Famous
← METER-MISER!

Efficient Frigidaire Mechanism Protected for 5 Years Against Service Expense!

● This Frigidaire Water Cooler is just what you need for most industrial purposes. It has full 10 gallons per hour capacity*—is built to stand up under the hardest kind of usage. It is powered by the world-famous Meter-Miser, the same type mechanism proven dependable and trouble-free in over 2½ million Frigidaire refrigerators and water coolers. Quiet and efficient, this Meter-Miser has an exclusive rotary design, eliminating pistons, connecting rods and other parts that cause friction and wear. Permanently sealed and oiled for life, it is protected for 5 years against any service expense.

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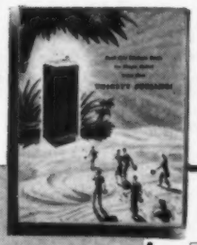
*Water cooled from 80° to 50° in 80° room, with 60% of water passing through pre-cooler.



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City and State ..... (FM-5)

Check List for Inspection and Overhauling of Air Conditioning Equipment

(*Continued from page 104*)

F. *Miscellaneous Items*

1. Check thermometers, gages, recorders.

2. Is air filter cleaning or loading equipment in order?

3. Check water treatment equipment (if provided).

Air Distribution Ducts

1. Check condition of any insulation and repair if necessary.

2. Check for loose duct hangers or supports.

3. Do volume dampers move freely, need lubrication?

4. Check damper operators and linkage for cleanliness, lubrication (if required), as well as for loose connections.

5. Are fire dampers in working order?

6. Check adjustment of any deflector vanes.

7. Check access doors of distribution ducts for tightness.

Supply Air Outlets and Grilles

1. Are they clean, securely attached, properly adjusted, in need of painting?

2. Check for adjacent obstructions that may block or deflect air from proper course.

Return Air Openings

1. Are openings blocked or restricted to prevent free entrance of air?

2. Check condition of screens, registers, or grilles.

3. Are they clean, in need of painting, securely attached.

Return Air Connections and Ducts

1. Check for tightness (to prevent drawing in unconditioned air when fan is running).

2. Check condition of insulation (if any) and repair if necessary.

3. Check for loose duct hangers and supports.

4. Check any fire dampers, volume dampers, damper operators, and linkages.

5. Check connections at air conditioning unit for tightness, etc.

Control Systems

A. *All Types*

1. If necessary to dismantle, repair, or adjust control devices, follow manufacturer's recommendation.

2. Make sure all instruments, mechanisms, and remote elements or bulbs are clean.

3. Check instruments for response to temperature and humidity changes.

4. Check instrument recorders for calibration.

B. *Pneumatic Type*

1. Check for air leaks in diaphragms, piping, etc.

2. Check for moisture or dirt in instrument air passages.

3. Blow out air lines and drip pockets to remove dirt and moisture.

4. Check diaphragm valves and air motors for response to control.

C. *Electric Type*

1. Check for blown fuses.

2. Check voltage at transformers.

3. Check contact points and potentiometer for dirt and burnouts.

4. Check damper and valve operators for response to control.

Refrigeration

It is assumed the refrigeration system is in the pumped-down condition. In carrying out any service work, do not operate compressor with discharge stop valves closed. Special precaution should be taken to prevent entry of moisture or foreign matter into any parts of the refrigeration equipment which may be open for repair or inspection. Any air which enters should be removed as soon as possible by evacuation or purging.

Refrigeration Compressors

1. Check for mechanical condition, seal leaks, bearings, etc. (Follow manufacturer's recommendations regarding repairs.)
2. Check condition of crankcase oil and replace if necessary.
3. Clean oil strainers and filters (if provided).
4. Check for leaky gaskets and joints (indicated by oil marks).
5. Flush out water jackets and make sure they are clean.
6. Thoroughly clean compressor and compressor parts.

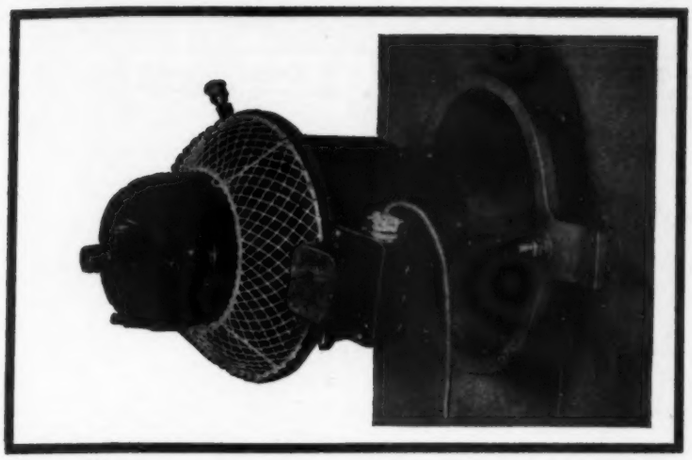
Compressor Drives, Motors, and Electrical Devices

1. Check belt condition, tension, and alignment.

2. Is belt guard in place and securely attached?

3. Clean motor and check bearings, windings, rings (or commutator),

(*Continued on page 108*)



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- ☐ drying of walls, sheets etc., after treated with coating material.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write below any special ventilating problem you may have.)

Check List for Inspection and Overhauling of Air Conditioning Equipment

(*Continued from page 106*)

brushes, and electrical connections.

4. Clean starters and check contact surfaces, electrical connections, trip mechanisms, etc.

5. Clean high and low pressure switches and check contact point surfaces.

6. Do switches operate freely without sticking?

7. Check vibration mountings (if any) and make sure they are not blocked.

Condensers

A. *Water Cooled*

1. Make sure water side is clean and flush out.

2. Check water supply valves and strainers for cleanliness and leaks.

3. Make sure water regulating valves operate freely and do not bind.

4. Check drains for obstructions.

B. *Air Cooled*

1. Clean condenser surfaces and any protective screens thoroughly.

2. Check for obstructions in any air ducts supplying these condensers.

C. *Evaporative*

1. Check interior parts, especially condenser coil, for cleanliness.

2. Check for corrosion and rusting.

3. Clean inlet and outlet screens.

4. Check hoods, cowls and duct connections. (Discharge duct leaks if inside allow escape of hot, moist air.)

5. Check fans, bearings and drives, motors, pumps.

6. Check water distribution, and clean spray nozzles.

7. Clean and paint where necessary.

8. Check water supply, level, float valve operation, etc.

9. Is water treatment required?

10. Check drains and overflow for obstructions.

Piping

1. Check insulation, where applied, for leaks or damage and repair same.

2. Check piping for oil marks indicating leaks.

3. Clean liquid line strainers.

4. Check expansion valve bulb clamps.

5. Check piping hangers and supports.

6. Check and correct conditions where rubbing or cutting is indicated (usually caused by parts bearing against piping).

Water Chillers

(Used in conjunction with spray type air conditioning apparatus.)

1. Check water side for cleanliness, and flush out.

2. Check insulation, and repair if necessary.

3. Check and clean safety thermostats and other control devices.

Testing

1. Open receiver valve to raise pressure on low side, then close, and carefully test the entire system for leaks with halide torch.

2. Repair and correct any leaks.

3. When system is free of leaks, open the receiver and liquid line valves, install suction and discharge gages, open discharge shutoff valves, replace fuses and prepare to operate refrigeration.

General Operating Check for Entire System

Start air conditioning and refrigeration equipment. Check suction and discharge pressures, compressor oil level, liquid flow (if indicator provided). While operating, check for dirty strainers, obstructions and the like. Correct such conditions before proceeding. Check water regulating valves, high and low pressure cutouts, and other control devices. While operating, recheck refrigerant system with halide torch. Check entire system for mechanical noise, vibration, overheating, or any other unusual operating condition. Check operation of thermostats, and other control devices, and response of air conditioning and refrigeration equipment.

When service check is completed, remove all testing equipment, tighten all refrigerant valve caps and leave system in operating order. Return all special tools, testing equipment, and spare parts, to their proper places. Follow up orders for spare parts, so that they will be on hand ready for use when required.

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Baker Truck carrying a 4-ton load of forged cranks from hammer to heat-treating department.

Two-hundred foot haul from plant to box car siding quickly made with 2-ton load of gear forgings.

Forgings crated for export loaded into car. Truck also handles loose or bagged forgings.

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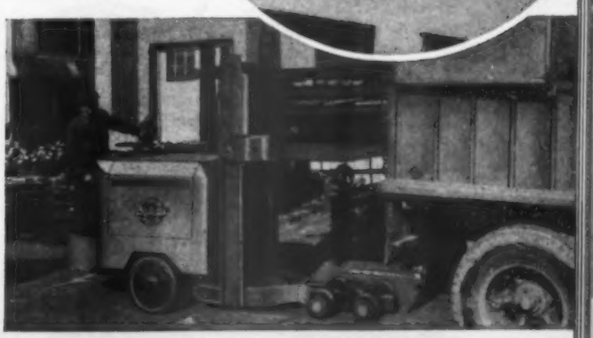

Thanks to BAKER TRUCKS!

Three Baker Hy-Lift Trucks are in constant 24 hour service at the busy Steel Improvement & Forge plant in Cleveland —with just a few hours out now and then for charging batteries. Heavy forged parts are carried quickly from hammers to heat-treating, to finishing and to shipping. Trucks also serve hammers with dies weighing up to 2 tons, and make millwright work easier and safer. In spite of the terrific pace set by increased production demands, time out for maintenance is negligible . . . Proof of satisfactory service is the fact that two more Baker Trucks are on order for the company's new plant, now under construction.

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You Want to Know

more about the items mentioned on this page. Letters to the addresses given will bring information

• SPIRALLY WOUND self-supporting transparent acetate tubing, preformed to eliminate shrinkage, has superior dielectric properties that recommend it for high-frequency and electronic applications. Precision Paper Tube Co., 2033 Charleston St., Chicago.

• "THE PAYROLL AUDITOR" computes wage rates from 30c to $1 in one-cent steps for time periods from ¼ to 81 hours, and thus saves you the mental effort of calculating payrolls in accordance with Federal Wage and Hour laws. The Payroll Audit Co., 112 East Broadway, Owatonna, Minn.

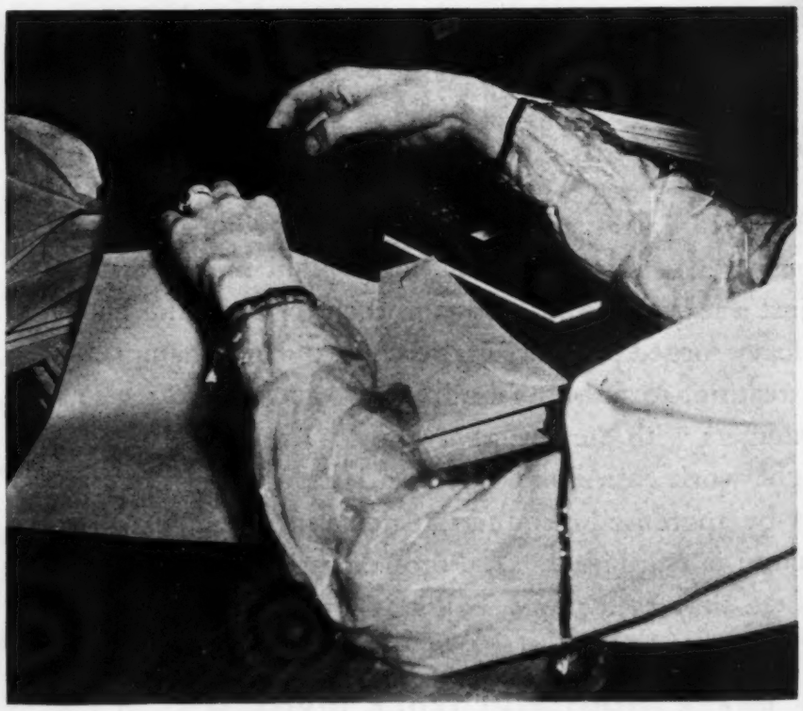
• DO YOUR EMPLOYEES know which fire extinguisher to use in case of gasoline, oil, and paint fires; rubbish and wood fires; or electrical fires? Poster gives basic facts on proper use and care of carbon-dioxide, foam, tetrachloride, and water-type extinguishers. Available, free, in any quantity. Walter Kidde & Co., West St., Bloomfield, N. J.

• YOU CAN QUICKLY figure out the proper metal for a particular application if you use a slide selector distributed by Ampco Metal, Inc., Milwaukee. It lists physical properties and chemical composition of the company's metals and tabulates their uses by grades.

• SPRAY KIT for burns contains a new preparation that is sprayed on all types of burns to lessen pain and shock of application. Also included is a spray gun, ready-to-use dressings, and accessories. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh.

• MACHINE TO END intricate calculations used in the Bedeaux system of production control is said to require but four seconds to analyze work of one employee. Merely set one lever for hours worked, another for hourly base pay, move a slide, and you have the answer. The Chart-O-Matic Calculator Co., Carew Tower, Cincinnati.

• SYNTHETIC wetting agent and detergent is said to be non-electrolytic, to contain no nitrogen or sulphur, and to leave no ash. Compatible with most any material, it is recommended for electroplating and acid scouring, scouring baths with and without soap, dyebaths and salt-



WOMEN in your office and plant, and perhaps also the men, will be glad to keep their light sleeves clean with these Pliofilm protectors which are said to be non-inflammable, waterproof, resistant to mild acid solutions and oil and grease. Protex Products Co., Jersey City, N. J.

The Higher P-Q* of SUN H.D. LUBRICANTS

STOPPED BEARING FAILURES
CUT MAINTENANCE COSTS
STEPPED-UP PRODUCTION

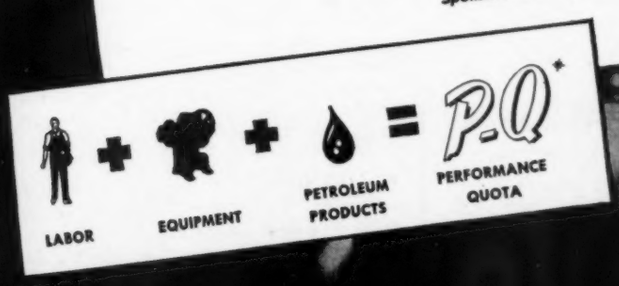
For years, engineers in a big rubber plant wrestled with the problem of lubricating bearings on the rolls of large mixers. Operating temperatures were up to 240° F. . . . pressures as high as 250,000 pounds per square inch. Bronze bearings failed and often ruined the rolls. Babbitt bearings saved the rolls but had to be renewed frequently. Many lubricants were tried . . . none were satisfactory.

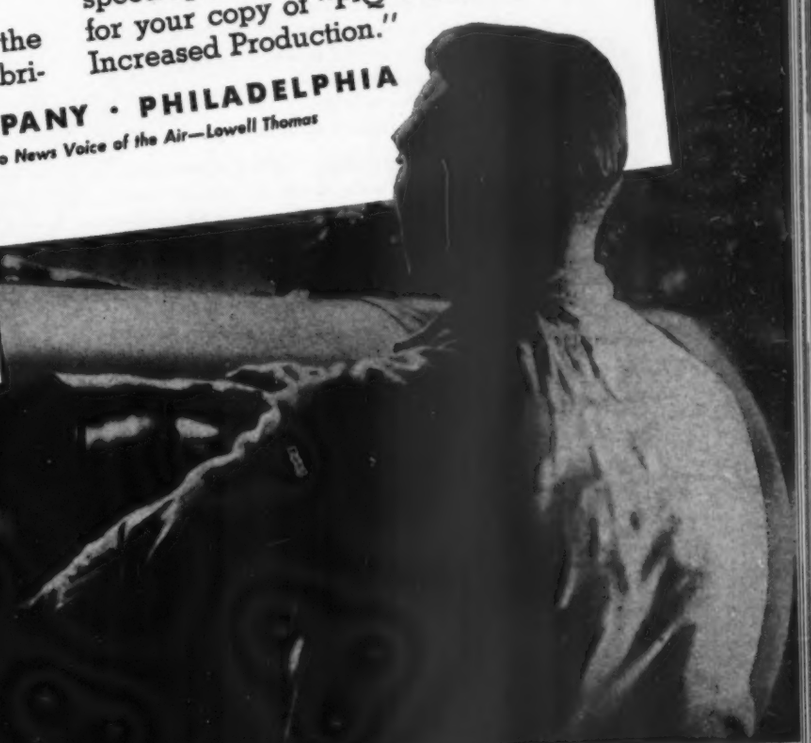
The answer was finally found in the higher P-Q* of SUN Heavy Duty Lubricants. There hasn't been a bearing failure since. Performance Quotas have been stepped-up. Operation is uninterrupted. The engineers say that bearings apparently will last for three or four years . . . or more.

What's the Performance Quota of your plant? Is it up there where it belongs? Perhaps the higher P-Q of modern SUN Industrial Lubricants can help speed up your production. Write today for your copy of "P-Q—Your Key to Increased Production."

SUN OIL COMPANY · PHILADELPHIA

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas





SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES

Copyright 1941 by Sun Oil Company

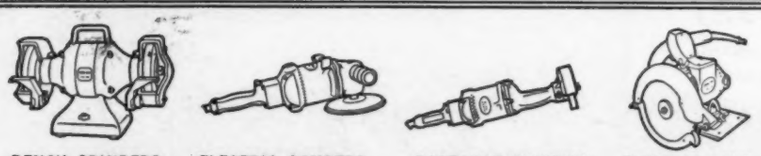
TOUGH BRUSHES TO LICK TOUGH JOBS

VAN DORN "WHIRLWIND" WIRE WHEEL BRUSHES

NOW *Van Dorn* brings you Wire Wheel Brushes *engineered* for longer life and better performance. Check these "WHIRLWIND" features—

- New, patented process locks wire in place.
- Each tuft independently anchored in.
- Higher quality steel wire.
- More strands.
- Built in sections for flexible service.
- 4, 6, 7, 8, 10 and 12 inch diameters.
- 3 thickness sizes.
- Fine or coarse wire.
- Patented adapters to fit any spindle size.

They fit any type grinding, buffing, polishing or cleaning machine. Tell your jobber you want to standardize on Van Dorn "WHIRLWIND" Wire Wheel Brushes in *your* plant. Van Dorn Electric Tools, 719 Joppa Road, Towson, Md.



BENCH GRINDERS ELECTRIC SANDERS PORTABLE GRINDERS ELECTRIC SAWS

"Van Dorn"
(DIV. OF BLACK & DECKER MFG. CO.)
THE "RED HEADED" PORTABLE ELECTRIC TOOLS

ing out solutions, strong acid mediums, etc. Rohm & Haas Co., 222 West Washington Sq., Philadelphia.

• YOU CAN GUARD against the entrance of saboteurs and other unwelcome visitors by installing a contactor, which sets off the alarm of any low-voltage signal, in the wood or metal frames and casings of doors, windows, cabinet and desk drawers. Edwards & Co., Norwalk, Conn.

• PAMPHLET lists approved standards for various industries and their prices. Index of the standards is included. American Standards Association, 29 West 39th St., New York.

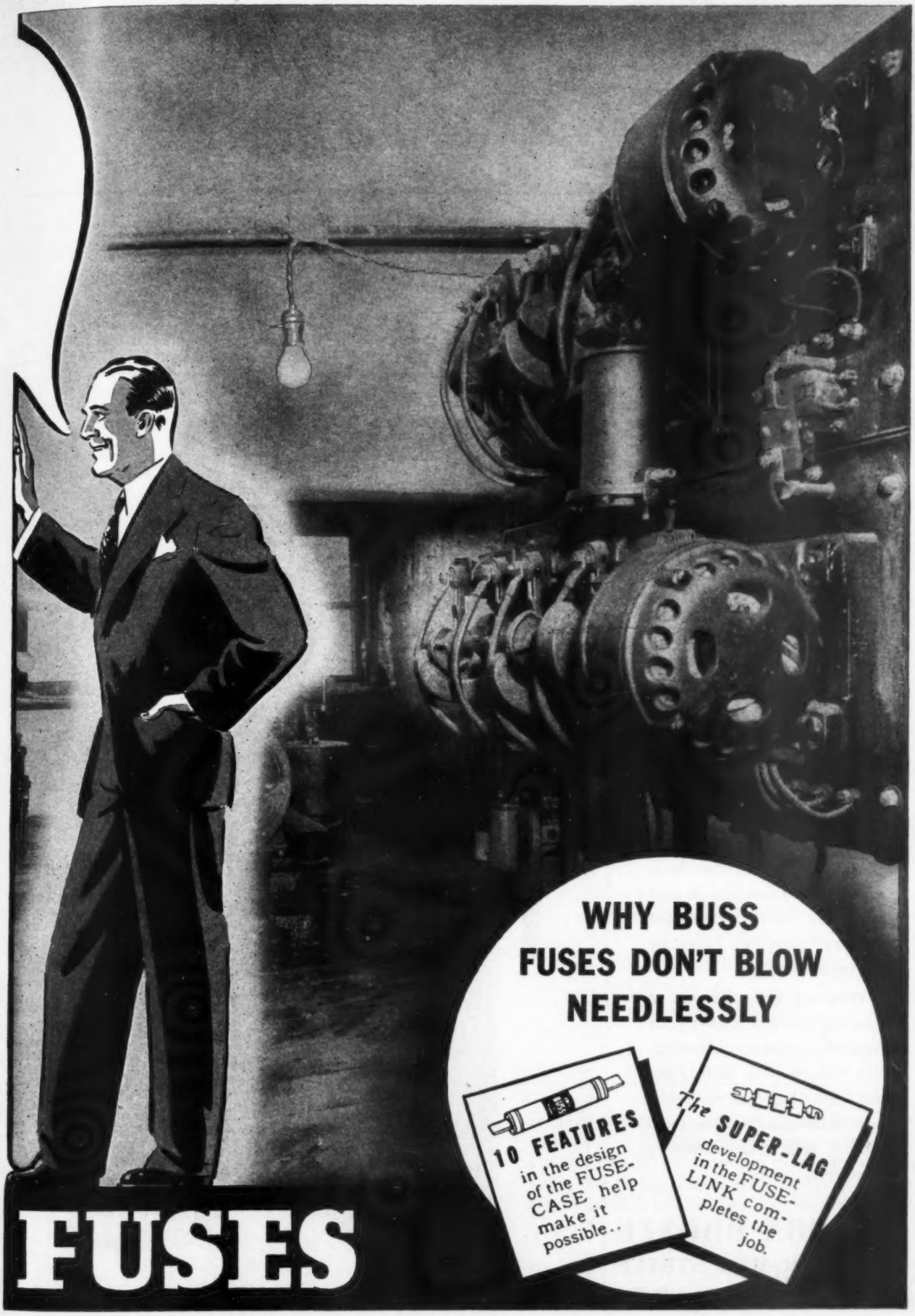
• APPRENTICE TRAINING blue print charts, of use to experienced machinists as well as to beginners, graphically outline essential information on lathe cutting tools, thread forms and formulas, and 60-deg. V-type thread dimensions. They measure 21x16¾ inches. Enclose 10c in stamps. Atlas Press Co., Kalamazoo, Mich.

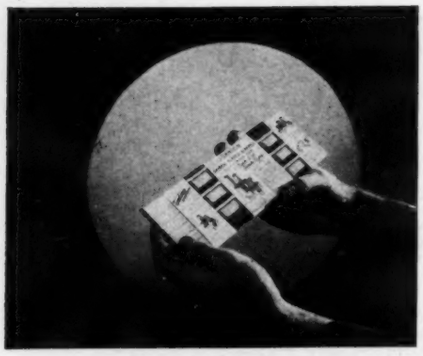
SAFETY is the main feature of this rubber multiple-outlet plug whose metal parts are inserted after it has been molded into a single unit. Able to resist heavy pressures, it is said to have withstood crushing tests up to 40 tons. United States Rubber Co., Rockefeller Center, New York.

• IF YOU ARE considering revamping your method of inventory control to meet present demands, you may find any number of worthwhile suggestions on control of supplies, direct materials, and finished goods in a report made available by Policyholders Service Bureau, Metropolitan Life Insurance Co., One Madison Ave., New York.

• IN OUR February issue we ran an article on Kearney & Trecker's farm-out plan. Now the United States Government Printing Office, Washington, D. C., has published a bulletin discussing farming out methods and describing how they have been put to work in various companies.

• REPORT on America's factories paints a favorable picture of possibilities for expanding America's manufacturing industries for defense. Discusses factory growth during the last four decades and looks into industries that continued to grow through the depression. 10c. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York.


WHY BUSS
FUSES DON'T BLOW
NEEDLESSLY
10 FEATURES
in the design of the FUSE-CASE help make it possible..
The SUPER-LAG
development in the FUSE-LINK completes the job.
FUSES



SLEEVE BEARING SLIDE RULE

● Here is an ingenious device that will enable you to tell at a glance if the sleeve bearings you require are standard stock items. You simply select the shaft size . . . then move the slide section to either right or left . . . and the correct combination of inside diameter, outside diameter, length and part number will appear.

This slide rule covers a range of over 800 stock size bearings. Every item listed thereon is available . . . in any quantity . . . immediately from stock. Every bearing is cast in S.A.E. 64 . . . the best general purpose bearing bronze available.

Why not write for one of these handy rules today? Your request carries no obligation. We will be glad to forward the rule, together with our new catalogue, and the location of your nearest source of supply.

JOHNSON BRONZE
512 SOUTH MILL STREET
NEW CASTLE, PA.

What's New in Equipment

Power Transformers

Announcement of a new line of power transformers in which weight and losses have been markedly reduced has been made by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Size and weight of distribution transformers has been cut as much as 25 percent, while copper losses have been reduced about 10 percent, and the short-time overload capacity increased.

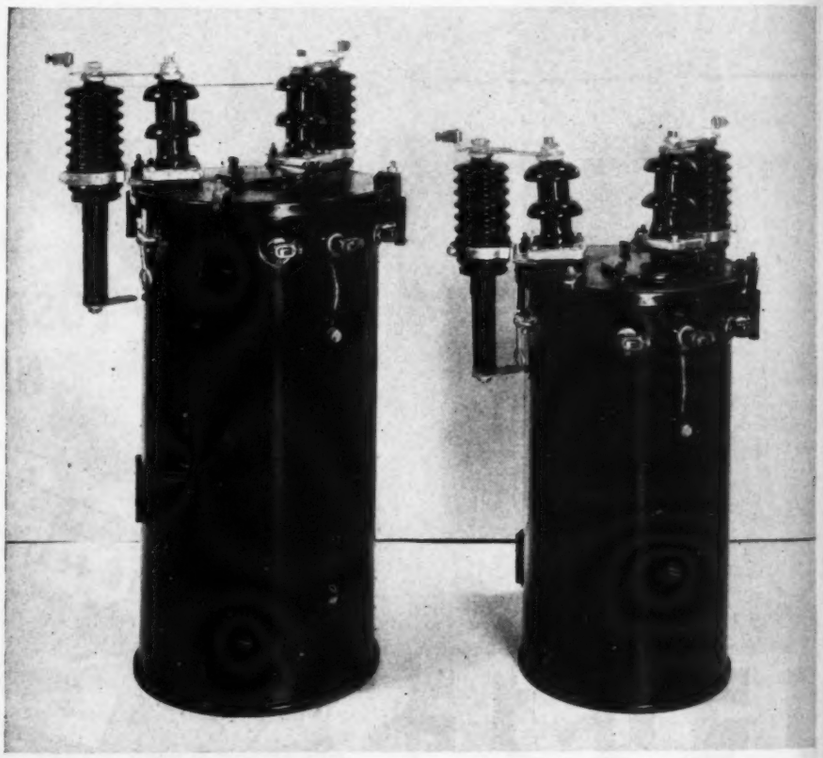
These advances in transformer design have been made possible by the development of an improved magnetic material, termed Hipersil, which is used in making the cores. It is claimed that this new material has one-third greater flux-carrying capacity than the best conventional silicon steel. In carrying this increased flux, no more magnetizing force is required and its losses will therefore be no greater. Also, its magnetostriction or sound-producing property is such that increased magnetic flux causes no increase in sound level.

Even at the higher densities at which Hipersil is utilized in transformers magnetostriction is said to be no greater at most, so that transformer noise will not be increased as a result of greater flux density in the core. Where unusual quietness is essential, a comparatively small reduction in flux density of the core should produce the desired effect.

Because Hipersil can be worked at higher induction than ordinary silicon steels the size and weight of transformer cores can be reduced; consequently fewer turns of copper are needed, and the average length of turn is diminished. This means that less iron, copper, and oil can be used, and that these components can be placed in a smaller tank.

Greater flux-carrying capacity of the new material can be used to good account in improving voltage regulation. Shorter average length of turns in the winding, with resultant lower copper resistance, reduces voltage drop at unity power factor, while a shorter mean turn and a smaller number of turns result in lower reactance, which reduces voltage drop at low power factor.

In transformers rated 15 kilovolt-amperes and less, voltage regulation has been improved, on the average, approximately 10 percent at unity power factor, and 12 percent at 80 percent power factor. In larger sizes, impedances are determined

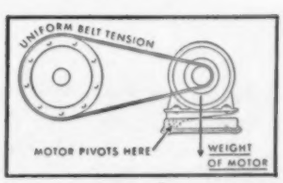


A Hipersil transformer, right, is smaller than a standard unit. Both are rated 10 kva.

A treaded surface grips better, slips less!

Buy VIM TRED Leather Belt for greater production!

You wouldn't buy a new smooth tire for your car. Why purchase a smooth belt, when you can get a treaded belt, certified to cost less per unit produced?

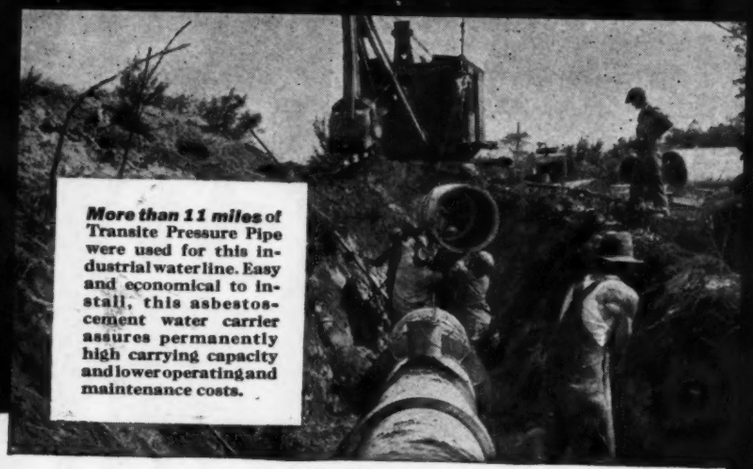


Combine this better belt with a pivoted motor base, and you have the most efficient, space-saving, short-center drive. When expanding or revamping your production facilities, be modern, be thrifty, be wise. Get VIM TRED Leather Belt, controlled by Houghton from hide to pulley. Write for sample.

E. F. HOUGHTON & CO.

Chicago - PHILADELPHIA - Detroit

What other water pipe has all these advantages?



More than 11 miles **of Transite Pressure Pipe were used for this industrial water line. Easy and economical to install, this asbestos-cement water carrier assures permanently high carrying capacity and lower operating and maintenance costs.**

Wherever Transite Pressure Pipe is used for industrial water lines, plant operators enjoy these important benefits—

LOW INSTALLATION COSTS—Transite Pipe is light in weight, easy to handle. The assembly method is so simple that even unskilled crews can form joints quickly. And joints *stay* tight . . . minimize leakage.

LOW UPKEEP COSTS. . . Made of asbestos and cement, Transite Pipe offers unusual resistance to attack by corrosive soils or cinder fills.

CLEAN WATER . . . Being non-metallic, Transite Pipe can't rust or rot. As a result, there's less danger of discolorations causing trouble in manufacturing processes or in finished products.

CONTINUED HIGH-DELIVERY CAPACITY. . .Transite's asbestos-cement composition makes it immune to the interior corrosion that cuts down the carrying capacity of ordinary pipe. As a result, pumping costs stay low. And smaller, less expensive sizes of pipe can frequently be used.

Before you install new water lines or extensions to existing ones, it will pay you to investigate J-M Transite Pipe. Write for brochure TR-11A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville

TRANSITE PIPE

For efficient, economical industrial water lines

by short-circuit considerations, rather than by regulation.

The simple magnetic circuit of transformers using the new material makes ventilation of the winding easy; therefore the temperature gradient between coils and oil can be reduced. Since copper losses for a given load are decreased, the quantity of heat generated in the winding is lessened and a greater short-time overload can be carried without exceeding safe operating temperatures. It is said that a typical distribution transformer of the new type will carry 2½ times full load for an hour, whereas an older transformer of the same rating can carry only 1.9 times full load for the same period and the same temperature rise.

In the new transformers provision has been made for easy replacement of coils, in the event that this becomes necessary, by making the Hipersil core in two pieces that can readily be taken apart.

These transformers are available in ratings of 1.5 to 500 kilovolt-amperes, 2,400, 4,800, and 7,200 volts.

Safety Goggle

Spectacle-type safety goggle features a double-braced bridge, comfortable rocking pads. Super Armorplate Clear or Calo-

bar lenses. It is designed to conform to the orbit of the eye; has insulated, heat-resisting, and perspiration-proof temples. Available in three eye and bridge sizes, it can be obtained with wire-mesh side shields which are said to be non-corrosive and easily cleaned. American Optical Co., Southbridge, Mass.

Pipe Vises

Heavy-duty No. 933 Vistand for portable or stationary use is constructed so as not to tip or tilt and is light enough to be carried in one hand. It has spreads of 50 in. in front and 43 in. from front to rear leg. The platform 14x14 in., includes tool notches and slots around the rim, an oilcan recess, and a special dope pot. There are three bends—one for ⅜-in. pipe and two reverse benders for ½- and ¾-in. pipe—placed directly over the right front leg to prevent tipping during the bending operation. The unit has a ceiling brace and its feet are punched for attaching to the floor or they may be equipped with skidless rubber shoes to protect polished floors. Double-quick screw with frictionless disk

protects the tip. Jaws are heat-treated and each tooth is undercut to prevent it from filling up with scale. No. 222 side open pipe vise may be installed on a bench or on the side or rear of a service truck. It takes pipe from ⅛ to 2 in. diameter. Armstrong Mfg. Co., Bridgeport, Conn.

Floodlight

Designed for general lighting purposes, the Floodlite delivers a concentrated flood or light in a medium beam effective in applications requiring intense illumination for exacting work. It is essentially an in-

candescent filament bulb with a lining of silver sealed inside to form a reflecting surface that does not dull or tarnish. Detachable swivel socket focuses the light exactly where needed when localized lighting is desirable. Made in the RE short bulb, in four sizes and four voltages from 100-300 watts and 110-125 volts. Wabash Appliance Corp., Birdseye Lamp Sales Division, 335 Carroll St., Brooklyn, N. Y.

Atomizing Nozzle

Parasol-type atomizing spray nozzle features a hollow cone-type spray having wide spray angle. Nozzles have polished orifice insert and are available with male and female ¼-in. pipe connection. Capacities range from 4-16 g.p.h. at 60 lb. pressure. Nozzles can be had with or without strainer. Standard construction is brass with 18-8 stainless-steel inserts (other materials specified). Recommended for spraying inside of cylindrical objects and whenever wide spray angle is required. Spraying Systems Co., 4021-D West Lake St., Chicago.

Automatic Oxygen Recorder

Using no chemicals, the recorder operates from the electric supply line and provides continuous indication and graphic record of amount of oxygen in any gas. Explosion-proof units are available for use in chemical plants or similar processing industries where gases may combine to form explosive mixtures. There the continuous indication of oxygen concentration permits proper control to eliminate the hazard. Determinations by the recorder are not affected by variation in constituents of sample gas because a differential measurement is performed. Standard range is 0-5 percent oxygen on a 10-in. scale but the recorder may be scaled in ranges of 0-2 percent full scale and 0-100

A RHOADS—PLANNED DRIVE...FOR

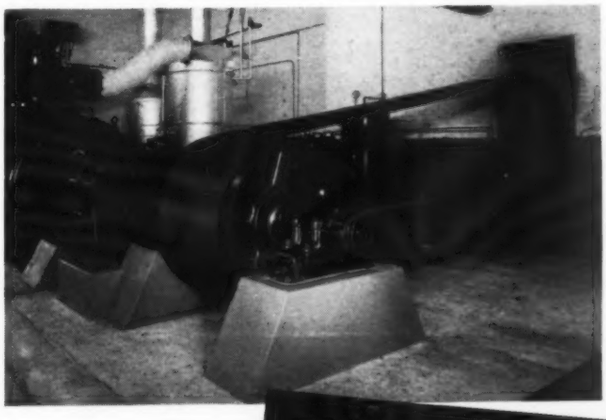
Production without Interruption!

HOW TO REVIVE WEAK DRIVES and SOUNDLY PLAN NEW ONES

▶ Rhoads has helped thousands of firms throughout industry to find the answers . . . to determine the right set-up for the specific problem . . . so that, from prime mover to machine, power flows smoothly, with maximum efficiency.

Today, more than ever, it is an important responsibility to keep production moving smoothly and keep unit cost down. And, you'll find it a great help, short-cut and time-saver, to call in Rhoads for advice.

Thousands of firms have found this a good way to obtain better drives at lower cost. A note on your letterhead puts Rhoads experience to work for you.



A RHOADS RECOMMENDATION for this Diesel engine drive was 32" four-ply Special TANNATE. Belt is running perfectly, gives every promise of years of efficient service.

STEP UP PRODUCTION with
RHOADS *Tannate*
WATERSHED LEATHER BELTING

Founded 1702—

J. E. RHOADS & SONS • 35 N. SIXTH ST., PHILA., PA.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

WE'LL BE GLAD TO DO THE SAME FOR You!

AP GRIEF BUSTER No. 2[illegible]

MACHINE TOOLS

THE GRIEF Men doing hand-finishing on metal in one of country's largest aircraft engine plants were having trouble with paper breaking and tearing. Production was slowed.

GRIEF BUSTER AP Engineer found that paper in use was not flexed properly for purpose. Recommended specially flexed paper. Production Sup[illegible] paper so flexed. ju[illegible]

AP GRIEF BUSTER No. 1133

PLASTICS

THE GRIEF Large manufacturer of plastics was using expensive paper for grinding flash from moldings.

GRIEF BUSTER AP Engineer suggested use of cheap, soft grain on strong backing. Finish was improved, and sandpaper costs were cut 84%. AP Paper now standard on this operation.

AP GRIEF BUSTER No. 298

WOOD-WORKING

THE GRIEF 8 drum double-deck sander in sash and door plant was wearing out covers in [illegible] hours.

GRIEF BUSTER AP Engineer found wrong type of sandpaper in use; recommended AP cover that cost no more. Top cover did 100 hours, bottom cover 125 hours with AP material. AP Sandpaper used ever since.

Your "Grief Buster" may be only a minor suggestion – or it may be a major change in your finishing operation. Either way, it will mean a bottleneck broken or some money saved. Your distributor will be glad to introduce you to the AP line of coated abrasives, packed in the exclusive "Masterpak" container that prevents moisture and handling damage. And he'll be glad to arrange for the AP Engineer to call at your finishing department. If you want a good source of supply on sandpaper, write Abrasive Products, Inc., 519 Pearl St., South Braintree, Massachusetts.

AP

ABRASIVE PRODUCTS INC.

ABRASIVE PRODUCTS

INC.

JEWELOX • JEWEL EMERY • JEWEL GARNET • JEWELITE • JEWEL FLINT • NEW PROCESS

percent full scale. Cambridge Instrument Co., Inc., Grand Central Terminal, New York.

Boiler-Tube Coating Machine

Applies protective coatings to interior of boiler, economizer, condenser, and other accessible tubing and is said to reduce tube-coating time and improve quality and uniformity of coverage. Consists of a pressure-feed container equipped with adjustable coating-pressure regulation. Operates with air-motor agitation, a single air-fluid line, and forced feed to expanding brushes through an air turbine. With operating hose lengths up to 150 ft. or more, connected to a working line up to 75 ft. long, the operator can pass the brush head all the way through the tube. Coating is discharged into path of rotating brush as coating unit is withdrawn. Useful in handling of long horizontal, bent, or vertical tubing. Dampney Company of America, Hyde Park, Boston.

Hydraulic Hand Lift Truck

The Load King hydraulic truck is built for continuous heavy-duty service. Capacities: 3,500, 5,000, 6,000, and 8,000 pounds. Hydraulic lifting unit is self-

contained and totally inclosed and has a 5-pt. oil reservoir; frame is one-piece and serves double purpose of elevating platform and elevating frame; wheels on standard models are smooth machine-faced steel and are equipped with ball bearings sealed to exclude dirt and foreign matter. Has 200-deg. lifting and steering arc. The Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia.

Ionizer

Static eliminating device consists of three transformers, a rectifying tube, and three Neutrastats mounted in an iron box measuring 8x8x15 inches. Two-pole attachment plug for 110 volts, 60 cycles, a.c. is provided. On the top of the unit is a single-pole, two-piece connector. The open-type static bar above the power unit has fiber disks to protect the points from mechanical damage. It is provided with 15 ft. of cable and is set up so that the points are directed toward the material to be discharged. Said to use a new method of electrically propelling static charges into space such that a static field

The Direct Way

AN ALL-ELECTRIC ADJUSTABLE-SPEED DRIVE FOR A-C CIRCUITS

RELIANCE V★S DRIVE

Speed Ranges up to 16 to 1 — Sizes 1 to 30 hp.

THE V★S way shortens the distance from power to work. It's the direct way, eliminating intermediate speed-changing devices, clutches, gear trains, a multiplicity of handles and knobs. It makes full use of the electric motor as a simple speed-changing device as well as a power unit (1).

From one handle in a convenient spot speeds are changed smoothly over ranges up to 16 to 1 while the machine is running. To stop, press a button; to start again, press another and the machine comes back to its previous speed (2).

And here are more features that help step up production: quick stopping, reversing, safe speeds for threading and inching, ample starting torque with smooth acceleration.

Using a proven principle of speed control, the Reliance V★S Drive now gives you these many advantages at a new low price. This is possible because of the packaged speed control unit (3) which is connected by three wires to a 3-phase a-c. power circuit. It takes little space and can be mounted anywhere.

RELIANCE ELECTRIC & ENGINEERING COMPANY

1088 Ivanhoe Road • • • Cleveland, Ohio

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE (S. C.) HOUSTON (TEX.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • PORTLAND (ORE.) ST. LOUIS • SAN FRANCISCO • SYRACUSE (N. Y.) • AND OTHER PRINCIPAL CITIES.

CONVENIENCE, WITHOUT LIMITATIONS

The start-stop button and speed changer can be placed anywhere that you can run a wire. Grouped with other control elements for the machine they make centralized control complete.

Get Bulletin 309 for details.

RELIANCE A-C D-C MOTORS

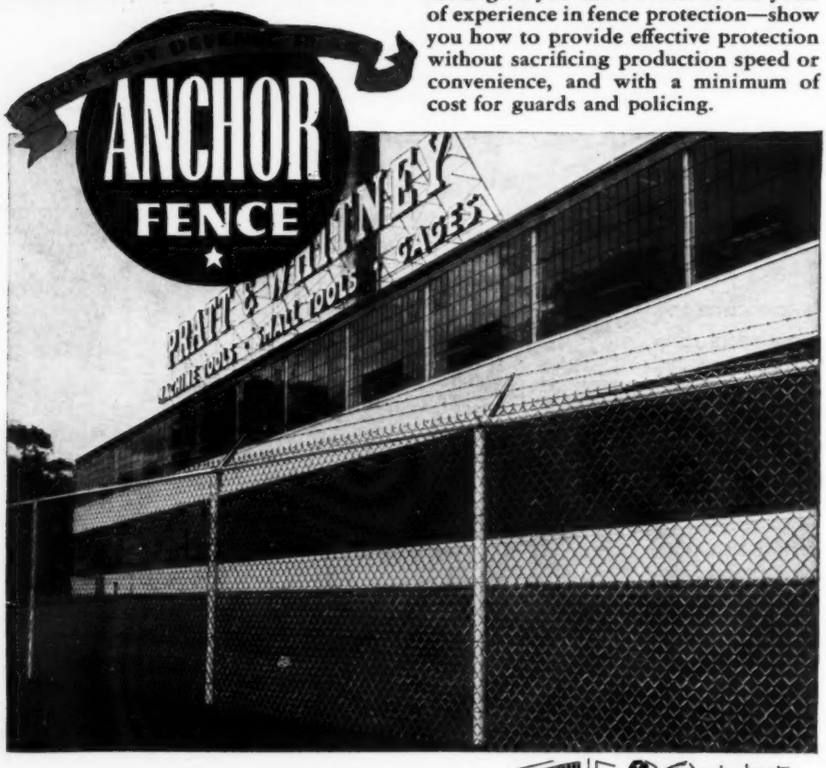
SABOTAGE -- IS FAST BECOMING A PRODUCTION PROBLEM

The Answer is . . . COMPLETE PROTECTION
An Anchor Fence AROUND YOUR PLANT
Anchor Fence Enclosures INSIDE YOUR PLANT

Government Defense Orders are placing an extra burden on industry's shoulders —the problem of protection from delays and losses from sabotage. There are two "musts" to sabotage protection today. First—a penetration-proof Anchor Chain Link fence around your plant to protect your buildings, equipment and personnel from outside sabotage agencies. Second—Anchor Fence enclosures *inside* your plant, around power stations, transformer installations, fuel, chemical and raw material storage to keep all but carefully selected employees away from these vital points.

Anchor Fences can be Moved in case of Plant Expansion

An Anchor Fence can be quickly installed, with our exclusive "drive anchors" which keep it permanently in line in any type soil. It can be moved in case of expansion without loss of posts or fabric. Send for the Anchor Engineer. He'll give you the benefits of his years of experience in fence protection—show you how to provide effective protection without sacrificing production speed or convenience, and with a minimum of cost for guards and policing.



AN ANCHOR FENCE ENGINEER will gladly help you plan complete protection for your plant. Write or wire today to: ANCHOR POST FENCE CO., 6620 Eastern Avenue, Baltimore, Maryland.

NATION-WIDE SALES AND ERECTING SERVICE

is produced equivalent to 100,000 volts or more, d.c., by generation of a few thousand volts. Aids in piling up light-weight papers at high speed in the delivery box of a paper mill; on the winder in a throwing mill it can be used to destroy static charges in acetate yarn. The Simco Co., 4929 York Road, Philadelphia.

Fluorescent Fixtures

Model 2026 for large-area high-intensity lighting employs two 100-watt T-17 fluorescent lamps measuring 5 ft. in length. They are corrected for power factor and stroboscopic effect. Model 2027 employs two 40-watt 48-in. fluorescent lamps and Model 2028 uses four such lamps. They also are corrected for power factor and stroboscopic effect. All three units are for ceiling suspension. Mitchell Mfg. Co., 2525 Clybourn Ave., Chicago.

Safety Lifting Clamp

Equipped with a replaceable, grooved, hardened, steel jaw liner, this clamp is

made for either horizontal or vertical lifting of steel plates, sheets, or sections and is available in ten styles for handling material weighing up to twelve tons and measuring ¼ to 6 in. thickness. Never-Slip Safety Clamp Co., P.O. Box 448, Grand Central Annex, New York.

Pipe Cutter

Four-wheel cutter provides increased cutting speed and facilitates cutting in close quarters. The wheels are designed to provide better balance and handling of the cutter under all conditions; to cut more evenly; to save time in cutting iron, steel, or brass pipe. Frame is malleable alloy, capacity is ⅛ to 2 inches. The Ridge Tool Co., Elyria, Ohio.

Engine and Cowl Mountings

Line of aircraft engine and cowl mountings of high-capacity load rating, employing neoprene for resistance to oil and ozonal attack at high altitudes and 18-8 stainless steel for resistance to corrosive effects of salt air at low altitudes, is available for industrial applications where

SHEAR TOOTH FILE for rapid soft-metal removal PLUS smooth finishing

"GET it going and get it done!" is the order of the day along the production lines of thousands of foundries and machine-shops sweeping ahead with the nation's defense activities. Here's a file that can "step along" under that sort of command! . . . It's the special-purpose Nicholson or Black Diamond Shear Tooth — a long-angle single-cut file that combines fast metal-removing with good finishing qualities.

See the chips fly as this deep-biting file roughs down a casting of aluminum, copper or brass! Then, under lighter pressure, see how this same file can work the part down to a smooth finish! Even plastics, hard rubber and wood respond to its action.

The Shear Tooth is one of an array of special-purpose files made by the world's largest file manufacturer to provide industry with *The right file for the job* under the famous Nicholson guarantee of *Twelve perfect files in every dozen.* Let your mill-supply house look after your requirements.

Free Technical Bulletin

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

The combination of the coarse single cut and long angle helps the Shear Tooth to clear itself of chips—minimizes clogging. Coarseness provides fast cutting; long angle gives shearing or shaving cut, leaving smooth finish. Note contrast with Mill Bastard below.

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

We Also Serve-

In tomorrow's battle for increased production and controlled costs, ordinary schedules will not be sufficient. Your first line of defense will consist of equipment that can keep rolling without costly breakdowns or repairs. Out-dated tools and out-moded methods will have to be discarded. Your uses of Truck Casters, for instance, should be given a careful check. Faultless technicians have been out on the front getting ready to meet your problems. New Caster designs and constructions have been devised to give longer life—to resist terrific, punishing abuse. Faultless distributors are near by to give you the kind of service you want. Simply write us, for literature, or a representative.

★Two rows of hardened, ground and lapped steel balls spread the load over a wider bearing surface promoting easy swiveling — minimizing breakdowns.

★A large diameter, genuine Hyatt Roller Bearing in the wheel assures easy rolling action. Either semi-steel or rubber tread wheels are available.

★The horn is of extra heavy gauge steel formed round and deeply embossed to stand the heaviest strains and jolts. Contains about 50% more metal than the ordinary caster.

★Special King pin construction eliminates any possibility of breakage at this vital point.

FAULTLESS CASTER CORPORATION
Dept. FM-5 Evansville, Indiana

Branches in principal cities. Canadian factory: Stratford, Ontario

FAULTLESS CASTERS
FOR INDUSTRY

operating conditions require neoprene and stainless. Method of manufacture creates a mechanical bond rather than a chemical one. Capacity rating is approximately 150 lb. per sq.in. axial load. Engine mounting measures 2⅝ in. long by 1¾ in. outside diameter. Cowl mounting measures 1½ in. length. Harris Products Co., 5419 Commonwealth Ave., Detroit.

Chain-Type Flexible Coupling

Type D flexible chain coupling is constructed to eliminate shearing of the pins in the chain. The pinions are cut diagonally so that one pinion pulls the other through the chain employing full tensional strength of the chain's width. Wear of teeth is distributed evenly across the entire face of both pinions, it is said. Ramsey Chain Co., Inc., Albany, N. Y.

Bearing Greases

Two lines of lubricating greases for ball and roller bearings are Anti-Friction grease for heavy-duty service and Precision grease for lighter duty and higher speeds. Both feature a high melting point, are specially prepared for greatest resistance to oxidation and separation, and provide a relatively smooth non-fibrous texture. Available in a wide range of consistencies for any method of application or operating condition. Gulf Oil Corp., Gulf Building, Pittsburgh.

Plugs and Receptacles

Heavy-duty plugs, receptacles, and cord connectors for use with portable electrical equipment are available in 2-, 3-, and 4-pole types, rated 10 amp., 250 volts and 15 amp., 125 volts. The 2-, 3-, and 4-pole contact units are interchangeable to permit use of a wide variety of plug shells and receptacle housings for assembly combinations. Contact units are reversible for safety protection. Enclosed female contacts may be assembled in either plug shell of receptacle housing depending upon which is connected to the live-line side of the circuit. This allows use of extension cords with cable connectors and convenient receptacles mounted on portable equipment without hazard of exposed live contacts. Plugs can't be inserted incorrectly, they say, nor be put into any receptacle having wrong number

Is your plant endangered by inadequate ventilation?

Lack of continuous ventilation, *not sabotage*, caused many of the nation's industrial disasters during 1940, according to the latest quarterly report of the National Fire Protection Association. As indicated in the accompanying "formula", explosions *which never should have happened* wrecked sprinkling systems . . . removed fire protection . . . and accentuated losses. If, in your plant, flammable fumes or dust are given off, prevent their accumulation and concentration with a rapid mechanical exhaust ventilation system. For safety's sake, have a *free* ventilating survey made—consult your classified telephone directory, pick up the phone and call our nearest office—or write us today!

ILG ELECTRIC VENTILATING CO.
2865 N. CRAWFORD AVE., CHICAGO, ILLINOIS
Offices in 43 Principal Cities

ILG

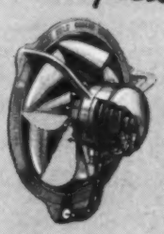
*Vitalized** **VENTILATION**
AND AIR CONDITIONING
*AIR CHANGE...NOT JUST AIR MOVEMENT!

FORMULA* *for a disastrous fire*

1. Speed up activity for National Defense.
2. *Forget to provide continuous ventilation.*
3. Explosive vapors or dust collect and ignite.
4. Explosion renders sprinkling system useless.
5. Without fire protection, plant burns, employees lose lives, work stops.

* *Digested from Quarterly Report of National Fire Protection Association.*

Complete VENTILATING *Service*

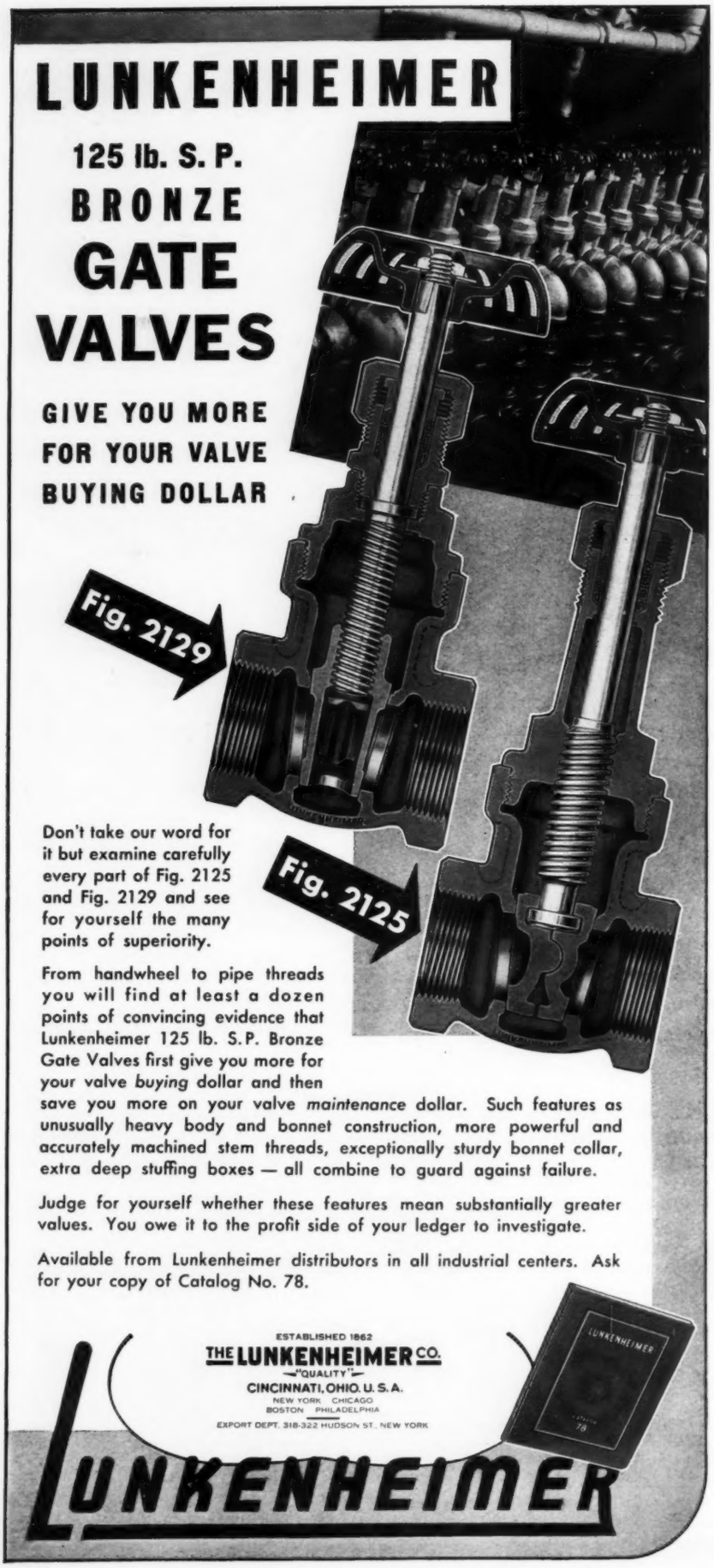


ILG PROPELLER FANS

. . . with *exclusive* self-cooled motor that "breathes"—*never gums-up!* Operate quietly, effortlessly, efficiently for years on end! 9½ to 72" sizes. Certified ratings. "One-Name-Plate" guarantee. Ask for Catalog F-482.

ILG UNIVERSAL BLOWERS

. . . direct connection of motor and wheel reduces cost of space installation, operation, maintenance, sound isolation. Wide range of types and sizes. Certified Ratings. "One-Name-Plate" guarantee. Request Catalog EB-381 now!


LUNKENHEIMER
125 lb. S. P.
BRONZE
GATE
VALVES
GIVE YOU MORE
FOR YOUR VALVE
BUYING DOLLAR
Fig. 2129
Fig. 2125
Don't take our word for it but examine carefully every part of Fig. 2125 and Fig. 2129 and see for yourself the many points of superiority.
From handwheel to pipe threads you will find at least a dozen points of convincing evidence that Lunkenheimer 125 lb. S.P. Bronze Gate Valves first give you more for your valve *buying* dollar and then save you more on your valve *maintenance* dollar. Such features as unusually heavy body and bonnet construction, more powerful and accurately machined stem threads, exceptionally sturdy bonnet collar, extra deep stuffing boxes — all combine to guard against failure.
Judge for yourself whether these features mean substantially greater values. You owe it to the profit side of your ledger to investigate.
Available from Lunkenheimer distributors in all industrial centers. Ask for your copy of Catalog No. 78.
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THE LUNKENHEIMER CO.
"QUALITY"
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EXPORT DEPT. 318-322 HUDSON ST., NEW YORK
LUNKENHEIMER
LUNKENHEIMER
78

of poles, nor in conventional wall outlet receptacles. Seven types of receptacle housings are available in addition to the cord-connector-type receptacle housing. The Pyle-National Co., 1334-58 North Kostner Ave., Chicago.

Wire-Rope Electric Hoist

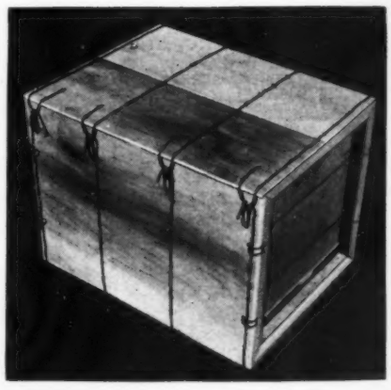
The Zip-Lift hoist is recommended for raising and positioning parts on machine tools, handling heavy load on delivery platforms or in storage rooms, for interdepartmental transportation of materials. It is available in 250-, 500-, 1,000-, and 2,000-lb. capacities, is light enough for a man to carry; can be mounted rigid or on hook or trolley with mountings interchangeable when desired; operates with pushbuttons; is powered from a light circuit. Features include brakes for safety of loads, automatic limit switch to prevent loads from rising too high, enclosed construction. Harnischfeger Corp., Milwaukee.

Air Circulators

Line of 24- and 30-in. air circulators features two-speed a.c. and d.c. operation; four styles of mounting—floor column, counter column, ceiling, wall bracket; aluminum blades and grease-packed ball bearings. The 30-in. fan delivers 8,600 cu. ft. of air per minute and the 24-in. fan delivers 6,100 cu. ft. of air per minute four feet from fan, it is said. Spiral safety guards are available for the complete line. The Emerson Electric Mfg. Co., St. Louis.

All-Bound Boxes

Containers for shipment of nuts, nails, bolts, washers are said to be relatively light in weight and thus afford savings in transportation charges. They are one-



piece shocks, packed flat, and two-thirds assembled, to save storage space. Can be re-used. General Box Co., 500 North Dearborn St., Chicago.

Weatherproof Inclosure for Service Equipment

Type F-A Raintite inclosure is for outdoor application—yard lighting, signs, floodlighting, and general use. The box is galvanized steel, bonderized cover, en-

There's more profit for you when you cut metals with DISSTON saws and files

Whatever metals you use . . . whether you're building airplanes or washing machines . . . there's profit for you in the greater speed and accuracy of cutting metals with Disston saws and files.

Speedier sawing . . . because tests show that Disston Di-Mol Hack Saw Blades last longer, cut faster and more precisely in modern high-speed machine sawing as well as in hand work. For cutting stainless steels and other hard metals, you'll save seconds by using Disston High Speed Steel Blades. On your band saw machines, speed production with Disston Hard-Edge, Flexible-Back Metal-Cutting Band Saws . . . they stay sharp, cut clean and straight through a wide range of metals.

Faster filing . . . because Disston Bite-Rite Files take off more metal with each stroke. Save finishing time, too, since a Bite-Rite files smoother, planing and leveling as it cuts.

Ask your Disston Distributor for the profit story on Disston metal-cutting saws, tools and files as applied to your business. Or write us today. Disston engineers will be glad to help with your production problems. Henry Disston & Sons, Inc., Philadelphia, Pa., U. S. A.

ESTABLISHED 1840

TRADE MARK

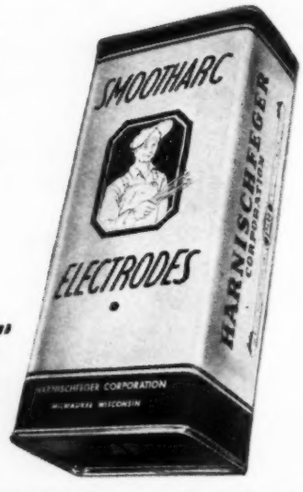
REG. U.S. PAT. OFF.

For salvage welding of carbon chrome, and carbon moly castings or other cast alloys of similar characteristics which are to be heat treated after welding. (Note the treatment of welded shrink cracks on heavy plate at right.)

"HARNIMOLY"—

Easily Machined in As-Welded State . . . Responds to flame hardening or heat treatment, up to hardness of 415 Brinell.

When used in repairing during heat treatment of metals similar to those above, "Harnimoly" makes it possible to obtain virtually the same characteristics as the parent metal in impact values.



P&H "Oven Dry" KEPT IN AIR-TIGHT CONTAINERS

WELDING ELECTRODES

To get all the facts about applications and procedures with P&H "Harnimoly," call your nearest P&H welding representative. Or write us.

General Offices: 4525 W. National Avenue, Milwaukee, Wis.

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WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

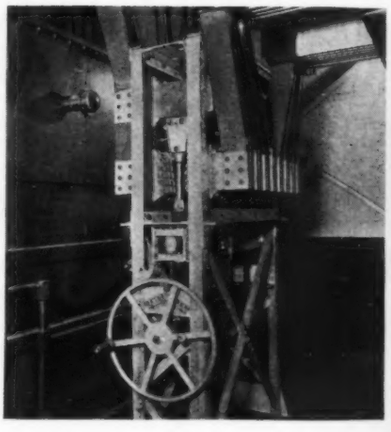
amel finish. Said to be impervious to rain, snow, and sleet. Hinged cover may be padlocked. Available for load centers and service equipment of 2-16 circuits, 120 volts. Large assemblies in panelboard construction also available in weatherproof inclosures. Frank Adam Electric Co., St. Louis.

Desk-Bracket Electric Fan

A 16-in. Power-Aire oscillating fan, with wide-area Micarta blades, comes in gunmetal gray. May be pedestal mounted as well as desk mounted. The Pacemaker model is available in mahogany brown. Other models in the line include a 10-in. and a 12-in. Power-Aire, ventilating fans, Whirl-Aire air circulators, and ceiling fans. Westinghouse Electric & Mfg. Co., Merchandising Division, Mansfield, Ohio.

Electric Furnace Switch

Double-throw, 48,000-amp. switch is used where high-ampere switching on electric furnace installations is required. The series parallel interconnections are factory assembled to permit direct connection to the 8-coil transformer terminals. Contacts are protected against heating due to oxidation, and supporting frame is non-magnetic to minimize inductive heating. Mechanism is interlocked to prevent opening under load. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.



Hand Tachometers

Direct-reading, centrifugal-type hand tachometers covering a wide range are available in four standard range combinations covering speeds between 30 and 48,000 r.p.m. Features: Rotating gearshift in a knurled cover for changing to the speed ranges, knife-edged pointers for accuracy in readings, 3-in.-diameter dial, direct reading of r.p.m. and f.p.m. Herman H. Sticht Co., Inc., 27 Park Place, N. Y.

Locknut

Designed to stay tight under all conditions, the nut is all metal and is said to be oil, heat, and moisture resistant. Does

Defense against slipping

BLAW-KNOX GRATING

A Blaw-Knox Electroforged Steel Grating Floor with the safety twisted cross bar that grips shoe soles and avoids accidents.

To protect your men and keep them on the job for National Defense, use BLAW-KNOX OPEN FLOORING in all places in your shops where there is a chance of falls due to underfoot conditions.

Send for paper-weight size sample showing safety cross-bar construction.

BLAW-KNOX DIVISION of Blaw-Knox Co.

2031 Farmers Bank Building · Pittsburgh, Pa.

NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM

Surveys show 3 to 1 preference for SCOTT TISSUES

IN TYPICAL buildings in three cities, these questions were asked:

1. ***What is your favorite brand of toilet tissue?***
   3 out of 4 who had a preference answered: "ScotTissue."
2. ***What is your favorite brand of tissue towel?***
   4 out of 5 who had a preference answered: "ScotTissue Towels."

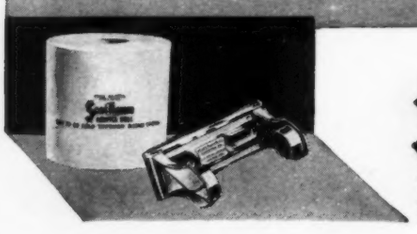
Men and women alike prefer ScotTissue for its balance of superior softness and strength. Provided in plant washrooms, it shows employees that you overlook no detail of comfort and protection. And ScotTissue is economical, too—packaged to be long lasting.

The new "Soft-Tuff" ScotTissue Towels are even *softer* than before . . . yet they have *10 times* more rub strength in use! Two-ply, full size, heavy weight . . . each has *double* the absorbent capacity needed for thorough hand drying.

Hundreds of leading industries have found these ScotTissue products valuable in building good will and cutting costs.

• • •

The Scott Washroom Advisory Service will help you arrange washrooms for greater comfort, hygiene and economy. It will suggest ways to improve traffic conditions, reduce waste and improve morale.



ScotTissue

Copr., 1941, Scott Paper Co., Chester, Pa. Trade Marks, "Scot Tissue," "Soft-Tuff" Reg. U. S. Pat. Office. Trade Mark "Washroom Advisory Service" Reg. applied for.

not depend on surface pressure for its grip. Rather, the elliptical-shaped spring steel retainer creates the pressure—only a wrench will loosen the nut thereafter, they say. Therefore valuable for use on equipment subject to vibration. Security Metal Products, Inc., 345 East Kalamazoo Ave., Kalamazoo, Mich.

Toggle Clamp

Small, light-weight toggle clamp, measuring 6 by 6 by $1\frac{3}{16}$ in., finds particular use in the aircraft industry. It is said to have a clamping ratio of 33:1 and is intended for holding parts during welding, drilling, machining, assembly, and other aircraft production operations. It is made of cold drawn steel and weighs $9\frac{1}{4}$ ounces. To avoid marring or denting of surfaces clamped, a special rubber bolt head to fit $\frac{3}{8}$-in. bolt is furnished with the clamp. Detroit Stamping Co., 330 Midland Ave., Detroit.

Portable Vacuum Cleaner

Noiseless vacuum cleaner, the noise is reduced to the mere sound of air rushing through the nozzle and cleaning tools, permits cleaning at hours most convenient. May be used, with the proper attachments

and cleaning tools, on walls and overhead pipes; for removing dust, chips, and litter from units during assembly; for cleaning boiler tubes and tops in power plants; for office cleaning of rugs, upholstery, floors. Weighs 50 lb. and can be rolled about on its casters or picked up and carried. Breuer Electric Mfg. Co., 5100 North Ravenswood Ave., Chicago.

Pipe-Line Filter

Model CPHLS incorporates radial fin construction in a water filter for use in paper mills, on hydraulic systems and humidifying apparatus, chemical plants, shirt factories, rolling mills. This construction permits large area of filtering medium in a relatively small space; e.g., a ra-

It's 9 to 1 you'll be "in a hole" too, IF you don't look to your Electrical Wiring NOW!

Ignorance may be bliss but it leads to many a pitfall—especially when it concerns the true condition of your electrical wiring circuits.

Just how safe is your wiring? Do you really know? Better find out before it's too late . . . before those new defense contracts add an extra burden to what may be already overloaded circuits. Remember, too, that even without that extra strain, authorities agree that nine out of ten industrial plants need rewiring.

Is yours one of them?

Anaconda's "Industrial Wiring Survey" and "Industrial Wiring Guide" will help you find out. The Survey enables you to make a step-by-step analysis of wiring conditions in your plant; the Guide tells you how to correct the conditions found.

Play safe! Send for your free copies now.

Two free books for you! They'll simply, surely find any electrical wiring trouble in your plant; explain how to correct it. Write for them today!

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USE MODERN IMPROVED

Anaconda Wire & Cable

..Like An *Enemy Agent* In Your Plant!

SPREADING discomfort — sapping vitality — slowing up production. Heat-Fag does its work quietly — unseen — *whenever men sweat.* For, sweating robs the body of its normal salt balance — and, doctors tell us that lowered efficiency, fatigue, discomfort follow — even sickness or cramps in extreme cases.

The defense against Heat-Fag is simple and inexpensive. Morton's salt tablets at every drinking fountain provide an easy way for workers to replace this salt loss . . . avoid the letdown and loss due to Heat-Fag.

AVOID HEAT-FAG
USE MORTON'S SALT TABLETS

Place Morton Dispensers At All Drinking Fountains

Morton's modern dispensers deliver salt tablets, one at a time, quickly, cleanly, and without crushing or waste. Sanitary, easily filled—durable and dependable.

Morton's salt tablets contain the most highly refined salt, pressed into convenient tablet form, easy to take with a drink of water. They dissolve in less than 40 seconds after swallowing.

Order direct from this ad, or from your distributor . . . a small investment that pays big returns.

DISPENSERS
500 Tablet size $3.25
1000 Tablet size $4.00

TABLETS
Case of 9000 10 grain salt tablets $2.60
Combination Salt-Dextrose Tablets per case $3.15

FREE..
write on your firm letterhead for a pocket size sample tube of MORTON'S SALT TABLETS, and new folder, "Heat-Fag and Salt Tablets."

MORTON SALT COMPANY
CHICAGO, ILLINOIS

dial fin construction insert 11 in. high by 8¼ in. in diameter has an active filtering area of 1,325 square inches. There are no moving parts in the filter. The insert can be removed when necessary. Units can be arranged for cleaning by backwashing with clean water. Staynew Filter Corp., Leighton Ave., Rochester, N. Y.

Pipeline Sight Glasses

Sizes range from ¾ to 2 in. for the screwed connection fittings and from 2½ to 8 in. for the flanged design. Bodies are of cast iron for pressures up to 125 lb. per sq. inch. Pyrex windows are held in place by gasketed steel frames. For use in sludge lines, oil lines, and wherever else an indication of flow is desired. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia.

Multi Motor Mounting

For the motorization of machine tools. Provides for individual motor installation on all types of used machine tools. Accommodates NEMA frames, Nos. 204 to 326, 1-15 hp. at 1,800 r.p.m., including practically all Canadian, British, South American, and overseas motors together with older and special motors up to 10 hp. used in the United States. No extra plates or rails are necessary. Provision is made for take-up of V-belts between motor and transmission. Three models; lathe-mounting bracket, standard shaper bracket, milling-machine bracket. Western Mfg. Co., 3428 Scotten Ave., Detroit.

Metal-Clad Switch

Roller arm of this switch is adjustable vertically through an arc of 225 degrees around its pivot pin and has horizontal adjustment in eight positions 45 deg. apart.

It is suitable for slide or cam actuation. A ¾-in. diameter roller of hardened and ground steel is carried on an oilless bronze bearing. The arm is lightweight aluminum die casting. The switch is rated at 1,200 watts up to 600 volts a.c.; is single-pole type with normally closed, normally open, or double-throw contact arrangements; operates on 2-4 deg. movement with pro-

"YANKEE" OFFSET DRIVER

Quick Removal of Stripper Plate from Die Set Without Removing Punch Holder from Press

FOR tight jobs like this you've been wanting close-quarter tools with "Yankee" speed and power. Now you can get them! See this new "Yankee" No. 3900. "Yankee" gets IN to the job. It ratchets. Job's done! "Yankee" Adapters take care of almost any and every type of screw. Bolts, too.

"YANKEE" Offset Ratchet Drivers are available in sizes to meet practically any close-quarter condition in driving screws or bolts. With these new "Yankee" Offset Tools there are no "hard-to-reach" screws!

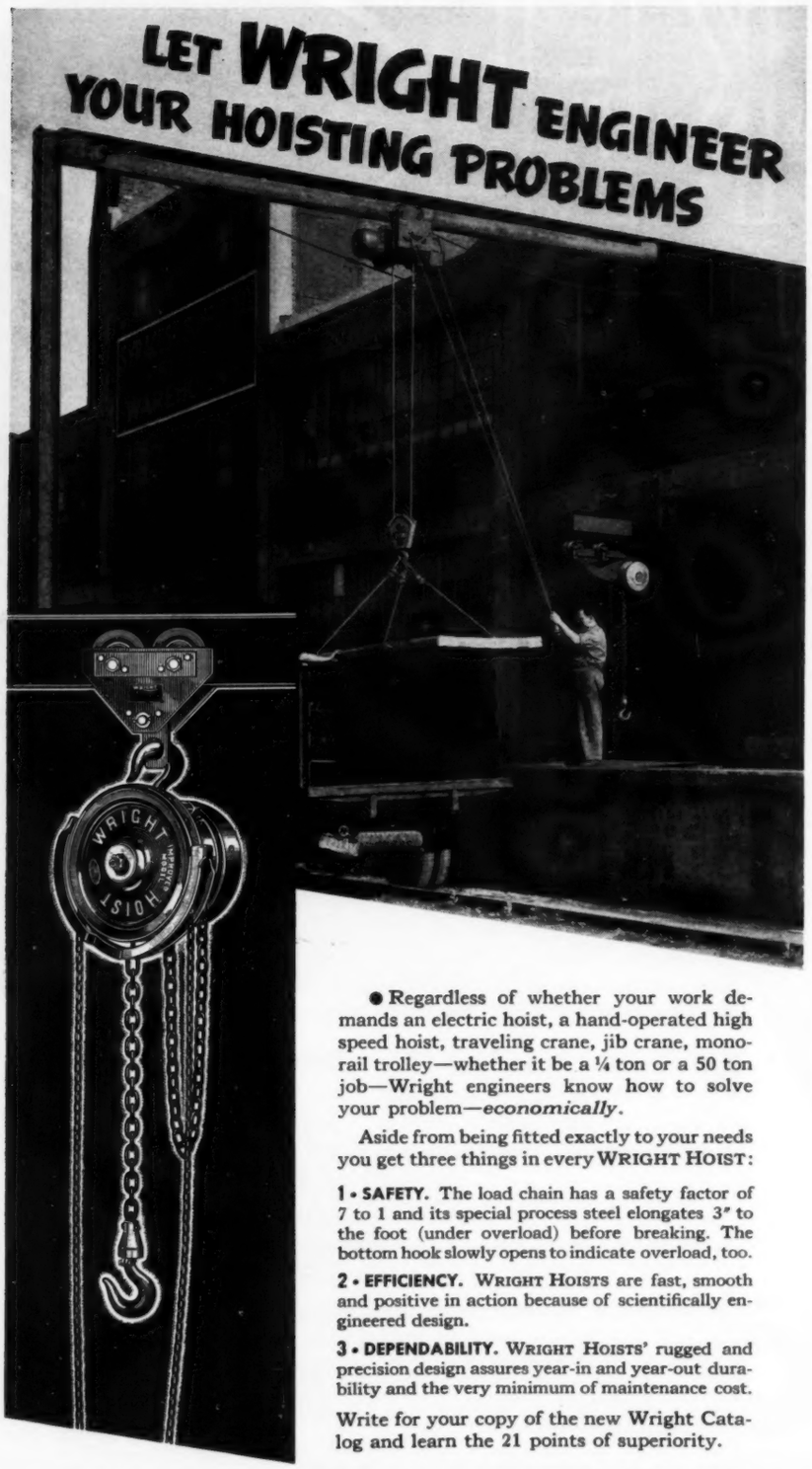
NO. 3900 — ACTUAL SIZE

"YANKEE" ADAPTERS FOR OFFSET DRIVER NO. 3900

No. 3901 SCREW DRIVER 6/16" x .045	No. 3902 SCREW DRIVER 1/2" x .040	No. 3911 HEX KEY 3/16"	No. 3912 HEX KEY 7/32"	No. 3913 HEX KEY 1/4"	No. 3914 HEX KEY 5/16"	No. 3921 SQUARE DRIVE 1/4"	No. 3922 SQUARE DRIVE 9/32"	No. 3923 SQUARE DRIVE 3/8"	No. 3931 PHILLIPS BIT 1 POINT	No. 3932 PHILLIPS BIT 2 POINT	No. 3933 PHILLIPS BIT 3 POINT	No. 3934 PHILLIPS BIT 4 POINT

ORDER FROM YOUR MILL SUPPLY HOUSE.
For complete showing of this new speed line of "Yankee" Offset Drivers . . . Adapters . . . Offset Kits,—Write for Offset Tool Folder "F."

NORTH BROS. MFG. CO., PHILADELPHIA, U.S.A.



● Regardless of whether your work demands an electric hoist, a hand-operated high speed hoist, traveling crane, jib crane, monorail trolley—whether it be a ¼ ton or a 50 ton job—Wright engineers know how to solve your problem—*economically*.

Aside from being fitted exactly to your needs you get three things in every WRIGHT HOIST:

1 • SAFETY. The load chain has a safety factor of 7 to 1 and its special process steel elongates 3″ to the foot (under overload) before breaking. The bottom hook slowly opens to indicate overload, too.

2 • EFFICIENCY. WRIGHT HOISTS are fast, smooth and positive in action because of scientifically engineered design.

3 • DEPENDABILITY. WRIGHT HOISTS' rugged and precision design assures year-in and year-out durability and the very minimum of maintenance cost.

Write for your copy of the new Wright Catalog and learn the 21 points of superiority.

Let Wright engineer your hoisting and crane problems. Work through the Wright distributor in your city. You'll find him listed in the classified telephone book.

WRIGHT MANUFACTURING DIVISION
YORK • PENNSYLVANIA

AMERICAN CHAIN & CABLE COMPANY, Inc.
In Business for Your Safety

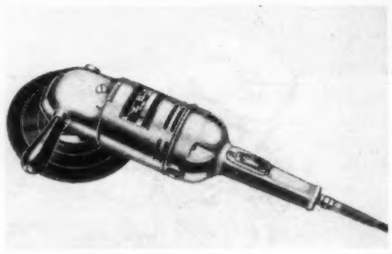
vision for 20-30 deg. overtravel of the arm. A ¾-in. conduit hub with wire way is provided. Micro Switch Corp., Freeport, Ill.

Rotary Pressure Joints

Type R joints are available in all the various styles in the 3-, 4-, 5-, and 6-in. sizes. They are applicable in paper and textile mills, chemical and food processing plants, wherever steam or liquids under pressure must be admitted in rotating rolls. The joints feature renewable wearing plates. All metal parts subject to wear are separate and renewable and can be furnished in bronze. Carbon-graphite ring takes the place of packing and is also self-lubricating. Provision is made to compensate for any lateral and angular misalignment. The Johnson Corp., Three Rivers, Mich.

Heavy-Duty Sanders

Built to work on the toughest and most difficult repair and production jobs—sanding, grinding, stuffing, and surfacing of wood, metal, and concrete. Come complete with bevel-type flexible pad, six abrasive disks (three for metal and three for wood), wrenches, and heavy rubber-covered three-wire cable. Flare cup grinding wheels can be used with these sanders for smoothing welds and surfaces where considerable metal is to be removed. No. 72 has a 7-in. diameter disk and a speed of 4,200 r.p.m., weighs 17¼ lb; No. 92 has a 9-in. diameter disk and a speed of 3,300



r.p.m., weighs 18 pounds. Universal motors operate on d.c. or a.c. Available in 115, 125, 150, 220, 230, or 250 volts. The Stanley Works, Stanley Electric Tool Division, New Britain, Conn.

Fluorescent Lighting Unit

Fixture for office installation is applicable to all commercial requirements. Reflector is finished in white Vitrolux fired porcelain enamel. Hanger and endplates are finished in satin aluminum. Available with or without hanger. Smoot-Holman Co., Inglewood, Calif.

Thermostatic Control

Self-contained, self-operated temperature control for tanks and processes regulates the flow of steam or water and is applicable on the steam supply to steam-heated water storage tanks, stills, pasteurizers, bottle and can washers, drying ovens, cookers, scalding vats, fuel oil preheaters. Said

MAHON *hydro-filter* SPRAY BOOTHS

This
patented HYDRO-FILTER
Removes All Danger
from FIRE
and FUMES

Action of the exhaust fan, located outside the unit proper, draws the paint-laden air through a series of conical, high pressure water sprays, confined in circular orifices. Centrifuge tubes completely separate the water and sludge from the air and deposit it in the tank below. Water flood sheet keeps back wall clean.

. . . *for* SAFER
. . . *and* BETTER
SPRAY PAINTING

whether you make a Radio or a Tractor

No matter what your product is—no matter how large or how small—the Mahon *hydro-filter* Spray Booth can be adapted to it. Here is a vastly superior spray booth ventilating system that eliminates fire and explosion hazards—that supplies to the operator a continuous flow of clean, fresh air—and that shows a decided saving in operating cost.

Mahon engineers will gladly cooperate with you in the layout of your entire spray painting production system. They will explain the superior features of the Mahon *hydro-filter* process. Let them show you why it will insure greater fire safety, efficiency and economy in all your spray painting operations. No obligation, of course.

THE R. C. MAHON COMPANY
DETROIT • CHICAGO

Designers and Manufacturers of Complete Finishing Systems, Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Drying & Baking Ovens, Dust Collectors, Filtered Air Supply Systems and Many Other Units of Special Production Equipment.

MAHON

...after *12 long years* of BEARING trouble....

Bronze bearings, carrying squeeze rolls heated with circulating oil at about 450°F., were giving lubrication trouble to a Canadian converting paper mill. "Dag" colloidal graphite has solved their high-temperature, high-pressure difficulty - they say, "For the first time in ten or twelve years we have been free from trouble on the bearings in question. We are surpised how long it lasts." ❖ ❖ ❖ "Dag" colloidal graphite blended with the petroleum oil provides the extra lubrication required under extreme conditions. ❖ ❖ ❖ Ask your oil supplier about his colloidal graphited industrial lubricants. Send for Technical Bulletin Number 130. . .

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

dag
REG. U. S. PAT. OFF.
COLLOIDAL PRODUCTS

Here are a few of the many uses of colloidal graphite in industry—check any with which you may be having lubrication difficulties.

"DAG" COLLOIDAL GRAPHITE FOR:

CONVEYORS..... ☐	SCREW THREADS..... ☐
FORGING DIES..... ☐	STEAM CYLINDER..... ☐
COMPRESSORS..... ☐	CASTING..... ☐
GLASS MOLD..... ☐	CONDUCTIVE COATINGS.... ☐
ASSEMBLY AND RUN-IN.... ☐	IMPREGNATION..... ☐

Tear off this coupon and attach to your letterhead—it will bring a working sample for the uses you specify.

ACHESON COLLOIDS CORPORATION • Port Huron, Michigan

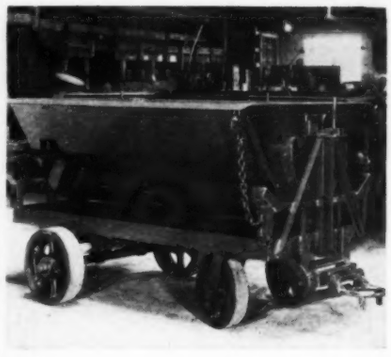
to control temperature within ±1½ deg. F.; has standard temperature range 120-170 deg. F. (other temperatures on order); suitable for pressures 0-30 and 0-125 lb.; available in sizes ½, ¾, and 1 inch. Sterling, Inc., 3706 North Holton St., Milwaukee.

Valve Stems

A new longer-wearing alloy, Hancodur, for valve stems and bonnets, is a self-lubricating alloy developed for use in the Superfinished "500 Brinell" bronze valves. Said to cut stem and bonnet wear to one-sixth the previous amount. It is also claimed that Hancodur stems have a tensile strength of 90,000 lb. per sq. in. plus a high self-lubricating characteristic that resists galling and wear. The Hancock Valve Division, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Dump Truck

Maneuverability is the main feature of this dump truck which handles coal, sand, gravel, small castings, scrap borings and turnings. In front, swivel casters are used. They have an over-all height of 19 in. with 16x4-in. rubber-tired wheels equipped with



Timken bearings. Rear wheels are 18x5 in., rubber-tired and bearing equipped. Frame is 85⅜ in. long by 36 in. wide. Hopper measures 45x78 in., capacity is 1¼ cu. yards. It can be made water-tight (by order) if oil, compound, chemicals, or other liquids are to be conveyed. Dumping is automatic. The Service Caster & Truck Co., 505 North Brownswood Ave., Albion, Mich.

Amplifier Equipment

Line of universal amplifiers for use in conjunction with photo-electric control devices is designed to provide standardized equipment to plants utilizing call systems or distributing radio and phonograph entertainment. The amplifiers vary in output power from five watts to several hundred watts. Lafayette Radio Corp., 100 Sixth Ave., New York.

Circuit-Control Panels

NTP panels with push-pull switches for individual circuit control are available in 4-40 circuits; 3-wire and 3-phase 4-wire service; 2-wire single (plug) fusing

Speed PRODUCTION ..*Save* POWER

Equip every drive in your plant with Gilmer BELTS

FROM aircraft factories to shipbuilding yards, from steel mills to chemical plants, alert manufacturers are finding that it pays to go Gilmer 100% . . . to equip all their drives with the correct Gilmer Belts.

For Gilmer has a complete line of transmission belts, four types of which are shown here.

And Gilmer Engineering Service really means business. Gilmer field engineers are constantly on the job . . . helping to design more efficient drives . . . making plant surveys of belt requirements which save dollars and days in ordering . . . passing along transmission problems to the Gilmer research laboratory . . . recommending belts to meet particular service conditions.

Write us today for the facts on how you can save money and speed production by equipping every drive in your plant with Gilmer Belts.

GILMER BELT SELECTOR—Supplement

Plant Application	Belt Recommended
Where endless V-belts are impractical because of obstructions.	Gilmer Streamliner V-Belting
Extremely high speeds, approximately 10,000 f.p.m. and over; no splice, smooth running.	Gilmer Speedage Fabric Belts
General flat pulley service where low first cost is main consideration.	Gilmer Standard Cut Edge Belting
Round belt drives—mule, serpentine, quarter-turn spindle, cross-drive—on small machinery.	Gilmer Round Endless Belts
Special fabric belts, for special flat drives and light conveyor applications.	Gilmer Cotton Web and Duck Belts

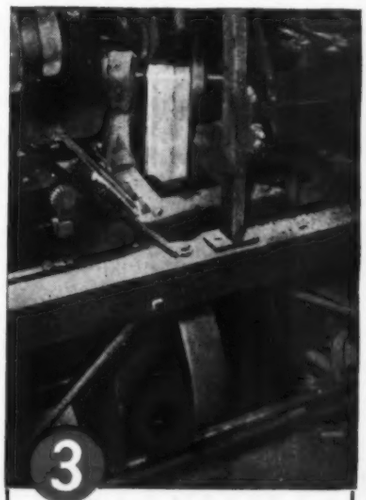
Besides the general applications illustrated and described above, Gilmer specializes in manufacturing belts and belting for specific industrial uses such as Planer, Spinner, Cone, Gainer, Tube-Winder, Stemming-Machine and Sander Belts. Oil resistant construction can be furnished on most of these belts. The Gilmer Engineering Department will gladly make recommendations.

L. H. GILMER COMPANY
TACONY . . . . PHILADELPHIA, PA.

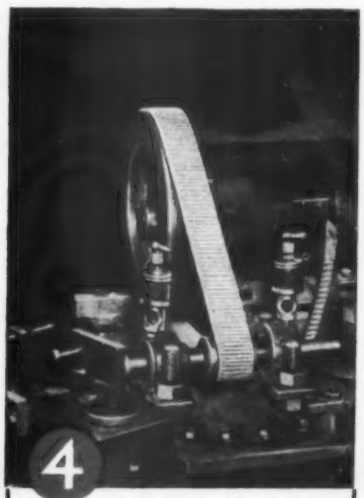
"The right transmission belt for every purpose"

Gilmer V-Belts are built with *normalized cords* for strength with minimum stretch, pull with less slippage. A complete line for multiple and fractional horsepower applications.

Kable Kord Endless Belts are really two-belts-in-one, with top contactor cords making the belt hug the pulleys . . . less slip, more power. Available also in running lengths.



Oil and heat resisting, Gilmer RHO Belts last longer, run smoother; ideal for small-pulley drives at speeds up to 7,400 f.p.m.



Made of a remarkable new patented material, Gilmer HEVALOID Endless Belts combine lightness, strength, grip and long life; for precision work at speeds up to 9,000 f.p.m.

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Representing the world's largest commercial producer of approved safety equipment, the M.S.A. man in your district has thorough knowledge and experience in safety, ready for you to use! Trained to serve you in every safety problem, you can count on his seasoned judgment and ability. Let him save you time and detail — in expediting fulfilment of your current needs, or in a shirt-sleeved analysis of your hazards on-the-job — without obligation.

MINE SAFETY APPLIANCES CO.

BRADDOCK, THOMAS AND MEADE STREETS
PITTSBURGH, PA.

branches; 30-amp., 125-volt, single-pole switches, surface and flush mounting. Box is built of galvanized steel and can be installed with main lugs at top or bottom. Door for panels up to 12 circuits have spring catch, 16 circuits and larger have spring lock and two keys. Interior block assembly is removable—any block can be taken out without disturbing remaining blocks. The Wadsworth Electric Mfg. Co., Covington, Ky.

Motor Pulley

For light machinery. The pulley mounts directly on the motor shaft and requires only standard V-belts. Features include short overhand, forced lubrication, balanced sheave, all-metal construction. Both halves of sheave move to give accurate belt alignment at all times. Pulley faces are curved so that the belt has full contact at all pitch diameters. Speed ratios up to 2¾ to 1, and sizes up to ¾ hp. are available. Complete unit includes variable pitch pulley and adjustable sliding motor base. The Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Exhaust Head

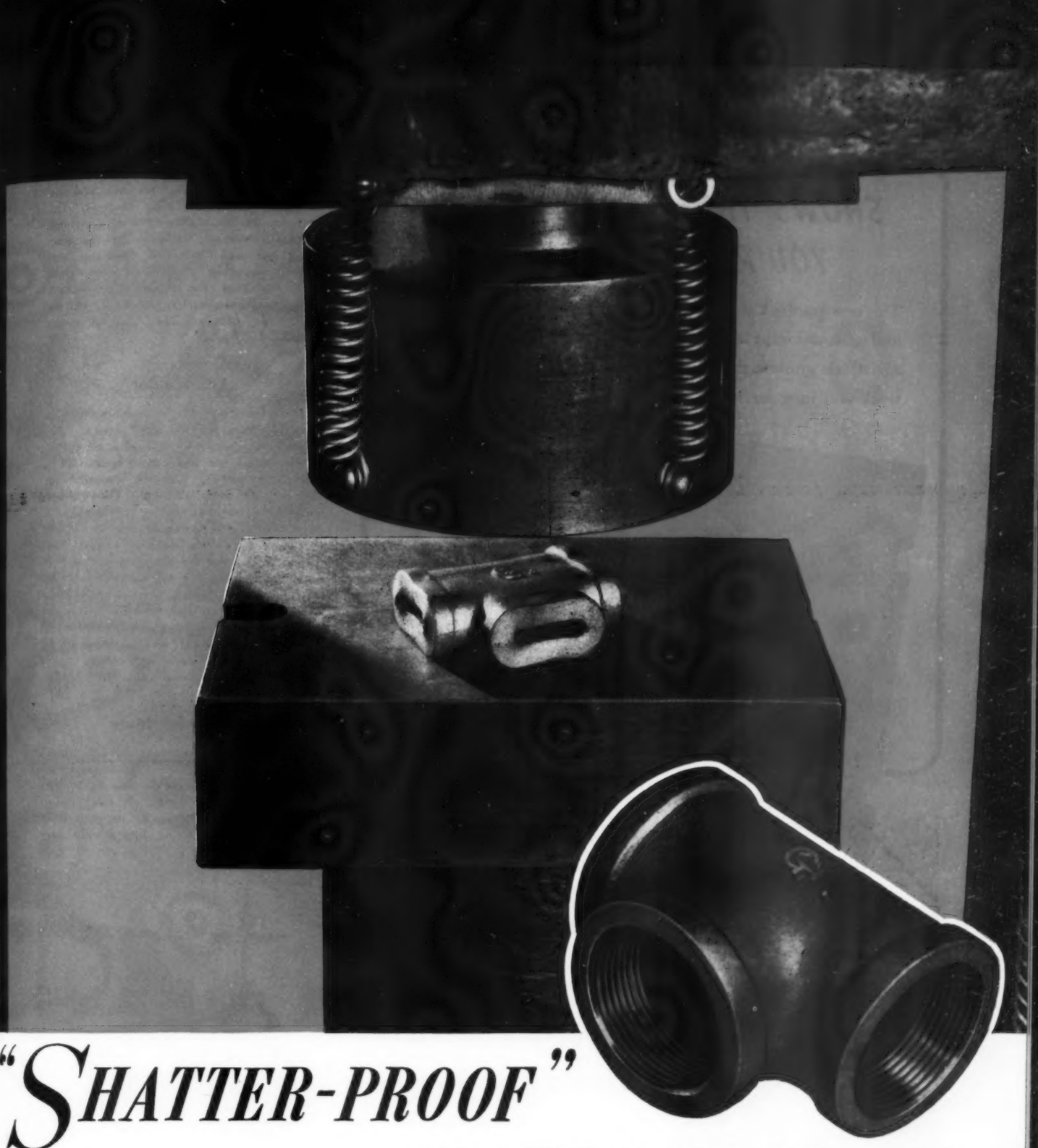
Insures separation of condensate and oil from steam discharged to atmosphere and thereby prevents raining of water and oily condensate upon roof or ground below while it discharges clean dry steam. Where the exhaust steam line from compressors, non-condensing engines, turbines, pumps, is protected by an atmospheric relief system, the head should be installed at the outlet of the atmospheric relief piping where the latter projects from the roof of the plant. The 4- to 12-in. (pipe diameter) sizes are one-piece semi-steel construction, 14- to 20-in. sizes are rolled-plate steel construction. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia.

Multiple V-Belts

Standard sizes for multiple V-drives. Heavy elastic fabric envelope takes up outside wear, permits flexing, and holds snugly to the groove. Cord section of high-tensile, low-stretch cords impregnated with liquid rubber and embedded in a cushion of rubber provides lengthwise flexibility and easy flexing around the pulleys. It also carries the load. Uniform cross sections enable each belt to seat itself in the groove. The Cincinnati Rubber Mfg. Co., Cincinnati.

Metal-Spraying Gun

Type 2E gun is used in restoring worn machine parts such as bearing surfaces, rolls, shafts, press fits with carbon steels, stainless steels, bronze, brass, monel metal, nickel, and also for the application of corrosion resistant coatings of zinc, aluminum, lead, tin to equipment ranging from nuts and bolts to water tanks and ships. The metal wire is automatially fed into the gun at an adjustable speed. There it is melted by means of concentrated



"SHATTER-PROOF"

because it's AIR-FURNACE *Metal!*

Why not get the extra strength and toughness of *Air-Furnace* malleable iron in pipe fittings, when it costs you nothing extra?

All standard Grinnell Malleable Fittings are made from Air-Furnace metal! The illustration shows what this means in added ruggedness. At 21,350 pounds pressure, this ¾" Grinnell Tee merely *flattened out*. Yet an ordinary cupola-malleable iron tee of the same size *shattered* into fragments when the pressure had reached only 16,500 pounds!

Grinnell offers a complete line of Air Furnace Malleable Fittings at no advance in cost. Available through wholesalers, heating and plumbing contractors, and branch offices in all principal cities. Write for catalog, "Grinnell Pipe Fittings". Grinnell Company, Inc., Executive Offices, Providence, Rhode Island, U. S. A.

AIR-FURNACE MALLEABLE IRON FITTINGS BY

GRINNELL

WHENEVER PIPING IS INVOLVED

SHOWS THE KIND OF TOOLS YOU'RE LOOKING FOR

This new Stanley Catalog of Industrial Tools is made to help you find what you want in a *hurry!* It's ready-referenced, easy to use, a complete guide to the Stanley Hand Tools that will deliver fine work and long service in your shop. Write for yours today!

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STANLEY

Chrome Vanadium Chisels and Punches

Electric furnace chrome-vanadium steel gives these tools the toughness to stand up under hardest work. They are drop-forged, hammer-drawn, hardened and carefully tempered. Shaped so they will not roll. Your distributor will be glad to supply these long-life tools.

STANLEY TOOLS
DIVISION OF THE STANLEY WORKS
New Britain, Conn.
THE TOOL BOX OF THE WORLD

flame, atomized by compressed air, and sprayed on base material. The controlled power unit provides uniform wire feed and eliminates need for gear changes. The universal gas head allows use of acetylene, propane, hydrogen, natural, or manufactured gas with balanced pressures and without changing heads. The gun weighs 4¾ lb., the gear case is made of aluminum alloy, parts are interchangeable. Metallizing Engineering Co., Inc., 21-07 41st Ave., Long Island City, N. Y.

Arc Welder

A.c. transformer-type are welder is available from 100–400 amp. capacity, and is made to operate on 220 volts, 60 cycles, single phase, or any single phase of a polyphase circuit. Can be supplied for 440 or 550 volts. Mounted on rubber-covered swivel casters for portability, it is also available mounted on two wheels designed for rough outdoor roads. Features: Series reactor designed for ease in striking and holding an arc, current control by a knob which automatically regulates voltage, non-inflammable heat-proof insulation, no rotating parts, value of current and size of welding rod to be used indicated for each dial setting. Eisler Engineering Co., Newark, N. J.

Industrial Mule

Designed to move standard lift trucks, towing trucks, tote boxes, drums, materials handling tubs and tanks, this mule handles medium-heavy loads. It has a 38-in. turning radius and can go through doorways and narrow aisles, into freight cars,

trucks, and elevators. Backing is done by reversing the steering wheel. Welded steel construction is used throughout. Powered by a motor mounted in the front wheel. For lighter work, an electric model is available. R. D. Eaglesfield, 301-400 South LaSalle St., Indianapolis.

Rubber Hose

Condor Homo-Flex hose is said to combine balance, homogeneity, and flexibility; to be light in weight, easy to handle; to have inseparable covers and plies, uniform diameters, less elongation and expansion. It is made in 50-ft. lengths on steel man-

BAUSCH & LOMB

Another nationally famous user of
MASTER MOTORS

BAUSCH & LOMB . . . for years that name has stood as a symbol for the highest of quality and integrity. To maintain their position, Bausch & Lomb optical products must be made from the best materials and with the most up to date equipment and processes. Bausch & Lomb engineers have found that they can add greatly to the convenience, economy, compactness and safety of their equipment, by using Master Motors built to meet the individual requirements of each particular job.

You, too, may have these advantages. Next time you need motors for your plant or your product, make it a job you'll be proud of with Master Motors built to meet YOUR requirements exactly. Investigate MASTER'S unusual ability to serve you promptly and economically.

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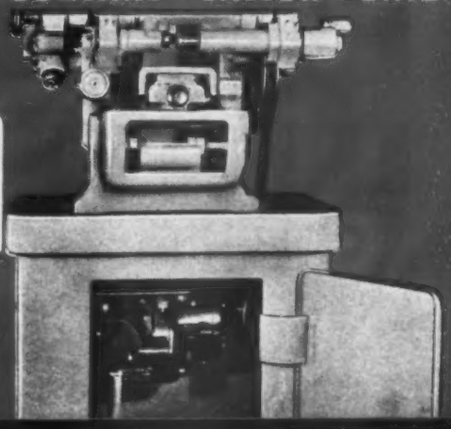

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IT'S MORE THAN A GOOD STORY..

Experience has proved it's economical to use

SCOTCH *Adhesive* TAPES

***for* MASKING**—Scotch Adhesive Tapes assure clean sharp color separation for two-tone work, strips, borders and small areas.

***for* HOLDING**—Scotch Adhesive Tapes hold doors, drawers, packing materials in place when preparing goods for shipment.

***for* PROTECTING**—Scotch Adhesive Tapes protect finished wood, metal or enamel surfaces from injury during assembly and shipping.

Scotch Adhesive Tapes are pressure sensitive—no moistening required. Application of tape is a fast, easy operation without need for special training or expensive equipment. Tape is easily removed when job is finished—no cleanup necessary.

If you are not already using Scotch Adhesive Tapes, write for sample roll and further information today.

Made and Patented in U. S. A. by

MINNESOTA MINING & MANUFACTURING CO.

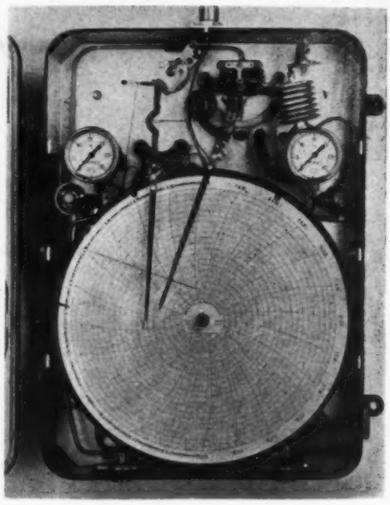
SAINT PAUL MINNESOTA

Canadian Manufacturers and Distributors, CANADIAN-DUREX ABRASIVES, LTD., 154 Pearl Street, Toronto, Canada

drels in several types for a variety of services—air hose, water hose, mine-spraying hose, air-oil and oil-spray hose, and steam pressing iron hose. The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

Temperature Controller

Pre-Set Free Vane temperature controller, air-operated throttling type, is used on processes where thermal characteristics are such that there is a tendency for temperature to exceed control setting of instrument on initial rise. On batch processes and the like, that are started up and shut down at frequent intervals, the controller introduces a presetting effect proportional to width of throttling range and rate of change of condition being measured and controlled and thus permits the controlled temperature to gradually approach the control point. Magnitude and duration of presetting effect may be adjusted over a wide range by adjustment of point-



er on an arbitrarily calibrated dial. Said to do a good job on shredders used in manufacture of rayon and cellophane. The Bristol Co., Waterbury, Conn.

Hardness Tester

The Impressor, a hardness tester for aluminum alloys or similar soft metals, plastics, hard rubber, and the like, facilitates testing the hardness of finished parts of almost any size or shape. Small and lightweight, it can be carried in the pocket. Pressure against the surface to be tested

IF YOU'VE hesitated about using Barreled Sunlight because you've heard it was a "premium-price" paint, here's welcome news for you:

Any plant, large or small, can afford to use Barreled Sunlight, for today this outstanding white costs no more than any ordinary good white paint!

But that's not all. On every job, Barreled Sunlight delivers important "on-the-wall" savings you can't afford to miss. THREE entirely different types of Barreled Sunlight are available. Each is designed for a specific job . . . made to do that job better and more economically. As a result, you can get just the white you need to meet the requirements of your plant as well as of your pocketbook.

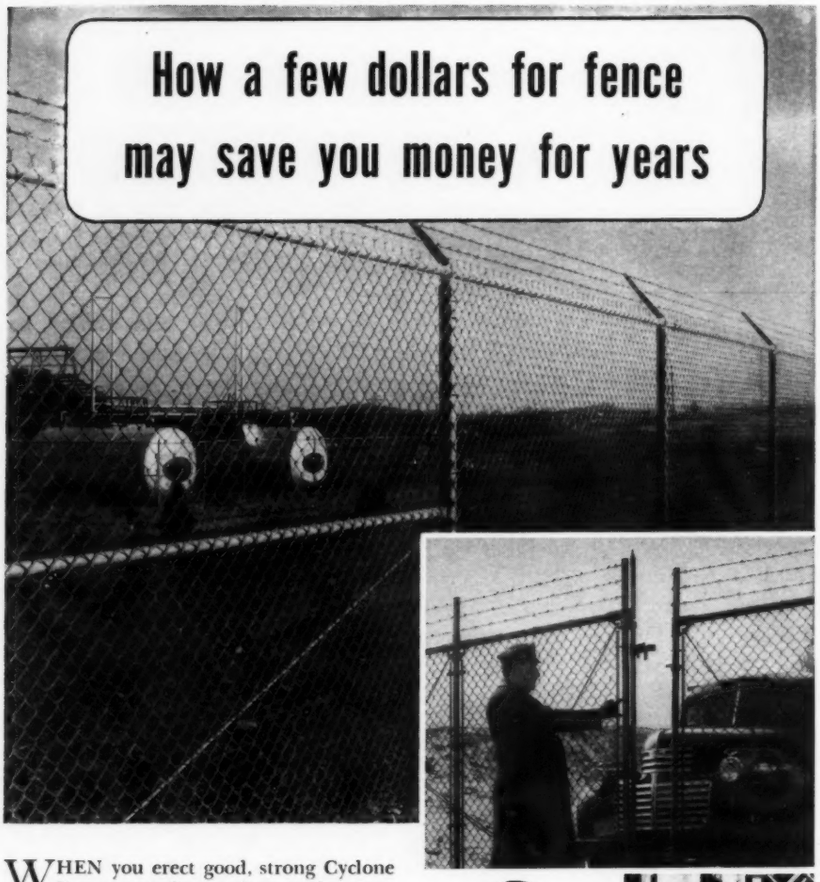
Call in your Barreled Sunlight Representative. Let him inspect your plant. He'll specify exactly the right Barreled Sunlight white for the job you want done. You'll find his recommendations will save you money . . . give you a finer, whiter, longer lasting paint job. Send for free booklet: "The Right Paint for Your Plant." U. S. Gutta Percha Paint Co., 2-E Dudley Street, Providence, R. I.

UNMATCHED FOR 40 YEARS, Barreled Sunlight *stays* first in the white-paint field because of never-ending research. Working with the secret Rice Process—*which cannot be copied because it defies chemical analysis*—Barreled Sunlight chemists have made Barreled Sunlight whiter and whiter, given it far greater white-retention, flowing, hiding and spreading powers. And because of this same research, you can buy Barreled Sunlight for the same price you'd pay for any ordinary good white paint!

BARRELED SUNLIGHT

SPECIALISTS IN WHITE PAINT FOR INDUSTRY FOR 40 YEARS

How a few dollars for fence may save you money for years

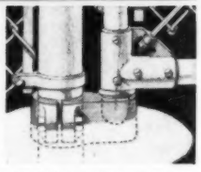


WHEN you erect good, strong Cyclone Fence around your plant you keep out thieves, saboteurs and other dangerous people. This is especially important now that blueprints, plans, dies and tools must be closely guarded. Cyclone Fence gives you complete control of movement to and from your plant. Your watchman can ask every person who enters the gates for credentials—can check every article carried out.

Cyclone's durability will keep your fence costs down. The strong H-column posts are set in concrete bases that frost won't budge. Spring couplings in top rails compensate for expansion and contraction. The copper-steel wire mesh is galvanized *after* weaving, leaving no cracks for rust to get started.

QUICK DELIVERY. We can meet almost any emergency delivery requirement. Our factory-trained erection crews build your fence quickly—and right. You can have Cyclone Fence, famous for quality, at a price comparable to any of similar designs. There's no obligation in getting a recommendation and free estimate. Write for it now.

This symbol represents the finest quality galvanizing money can buy. "12M" fights rust, makes fence last longer, saves money. Get the facts about "12M" before you buy fence.



A CYCLONE gate is easy to handle — it doesn't drag. The weight of the gate does not hang on the post. It is supported on a ball and socket hinge set in a solid concrete base.

CYCLONE FENCE DIVISION
(AMERICAN STEEL & WIRE COMPANY)
Waukegan, Ill., Branches in Principal Cities
United States Steel Export Company, New York

32-Page Book on Fence

Send for our free 32-page book that tells all about fence. Crammed full of facts, specifications and illustrations. Shows 14 types—for home, school, playground, and business. Whether you need a few feet of fence or 10 miles of it, you need this valuable book. Buy no fence until you see what Cyclone has to offer.

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Please mail me, without obligation, a copy of "Your Fence—How to Choose It—How to Use It."

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I am interested in fencing: ☐ Industrial; ☐ Estate; ☐ Playground; ☐ Residence; ☐ School.

Approximately .....feet

USS CYCLONE FENCE

UNITED STATES STEEL

produces a direct reading on the dial. It may be used vertically, horizontally, inverted. Useful in detecting accidental use of materials which are identical except for hardnes. Barber-Colman Co., Rockford, Ill.

All-Metal Mercury Switch

The Tiny Tipit switch has a capacity of ½ amp. at 24 volts to 4 amp. at 6 volts. It is useful wherever infrequent operation of a low-watt circuit is desired and for use in explosive atmospheres and on electrical machinery. It mounts in a small holder with screw stakes for terminal connection. The assembly is attached to a movable member, the movement actuating the switch. Operates on a tilt of 20 deg. or more. Durakool, Inc., 1010 North Main St., Elkhart, Ind.

Storage and Wardrobe Cabinets

Includes double-door and single-door storage, wardrobe, and combination cabinets; also Desk-hi, Counter-hi, and janitor's cabinets. Main feature is the round-corner construction—no sharp corners or edges to catch clothing or cause accidents. Other features: No exposed bolt heads on front or sides, closed bases 4¾ in. high, doors that swing open 180 deg., top and bottom channels inside the cabinet to act as doorstops without projecting into storage area, storage shelves adjustable every 2 inches. Available in white, grained walnut, grained oak, grained mahogany, walnutone, flat brown and flat gray. Lyon Metal Products, Inc., General Offices, Aurora, Ill.

Cable-Reel Jacks

Model 3-CR ratchet-type jacks are designed to speed handling of cable reels so that cable, wire rope, barbed wire, or rope can be quickly paid out or rolled onto the reel. Each jack is mounted on a T-shaped, laminated, oil-treated oak base with three supporting rods for stability. Lifting hook on head of the jack accommodates spindles up to 2½ in. diameter. When the jacks are used in pairs, one on

Designed, built and tested as a Gearmotor
WESTINGHOUSE DOUBLE-REDUCTION GEARMOTOR
Building both gears and electric drive in its own plants enables Westinghouse to furnish gearmotors that will handle full motor torque.
POSITIVE SPLASH LUBRICATION—assures trouble-free operation of drive.
SPLIT CASING—gives easy access to rotating parts.
SLOW SPEED SHAFT—delivers exact hp and speed required.
COMPACT MOUNTING—readily installed in small space.
BALL BEARINGS—cut friction losses to minimum.

In the design and construction of Westinghouse Gearmotors, Westinghouse engineers do not consider the reduction gears and the electric drive as separate units. A Westinghouse Gearmotor is designed, built and tested as a complete slow speed drive—a drive in which all parts are matched to provide maximum performance. By building its own gears Westinghouse gives the geared drive exactly the characteristics necessary to get the highest efficiency possible from the complete unit.

Another advantage for the user is the fact that Westinghouse Gears are made of heat-treated, forged steel, cut by the hobbing process—the most accurate method of gear cutting yet devised. This assures quiet operation and the ability of the reduction gears to transmit the full torque of the motor under load and to withstand the shocks of severe service.

GEARMOTORS GIVE THE ADVANTAGE OF HIGH SPEED MOTOR EFFICIENCY & POWER FACTOR

For complete information on how you can cut operating costs for your slow speed drive requirements, write or call Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

J-07180

Westinghouse

GEARED DRIVES

SLY DUST CONTROL . . .

at the plant of the American Nepheline Corp., Rochester, N. Y.

• This collector handles 41,000 cubic feet of air per minute. Two other Sly Dust Filters are in use in this plant. The nepheline syenite fines are used in the enamel and pottery trades.

SLY DUST FILTERS WILL GIVE YOU THESE *Exclusive* ADVANTAGES

1. MORE FILTERING CLOTH. Sly gives many more square feet of *effective* filter cloth area, hence greater filtering capacity per cubic foot of space.
2. TAUT BAGS. This patented feature insures: (1) a constant *minimum* resistance to the air, and (2) quick, thorough dust removal since the *entire* bag is vibrated *uniformly* during shaking.
3. SIMPLER SHAKER MECHANISM. Consists of many less moving parts, resulting in less maintenance and lower costs.
4. AUTOMATIC CONTROL. Sly gives *any degree of automatic control* up to *complete* automatic; minimizing or even removing entirely the human factor.
5. BAGS MORE EASILY REPLACED. Although Sly filter bags last a long time, when the bags do need replacing any individual worn bag can be readily replaced without disturbing the others.

Ask for Bulletin 98, and tell us about your problem so that we can write you fully.

THE W. W. SLY MFG. CO.

4755 Train Ave. *Branches in Principal Cities* Cleveland, O.

SLY
INDUSTRIAL DUST CONTROL

each side of the reel, the ratchets provide for fast lifting and lowering of loaded or empty reels. They have a capacity of 15 tons. Templeton, Kenly & Co., 1020 South Central Ave., Chicago.

Solderless Lugs

Line of solderless Handi-Lugs in five sizes—30-60, 100, 200, 400, and 600 amp. covers a range of wire sizes from No. 14 to 1,000,000 circ.mil. Three intermediate

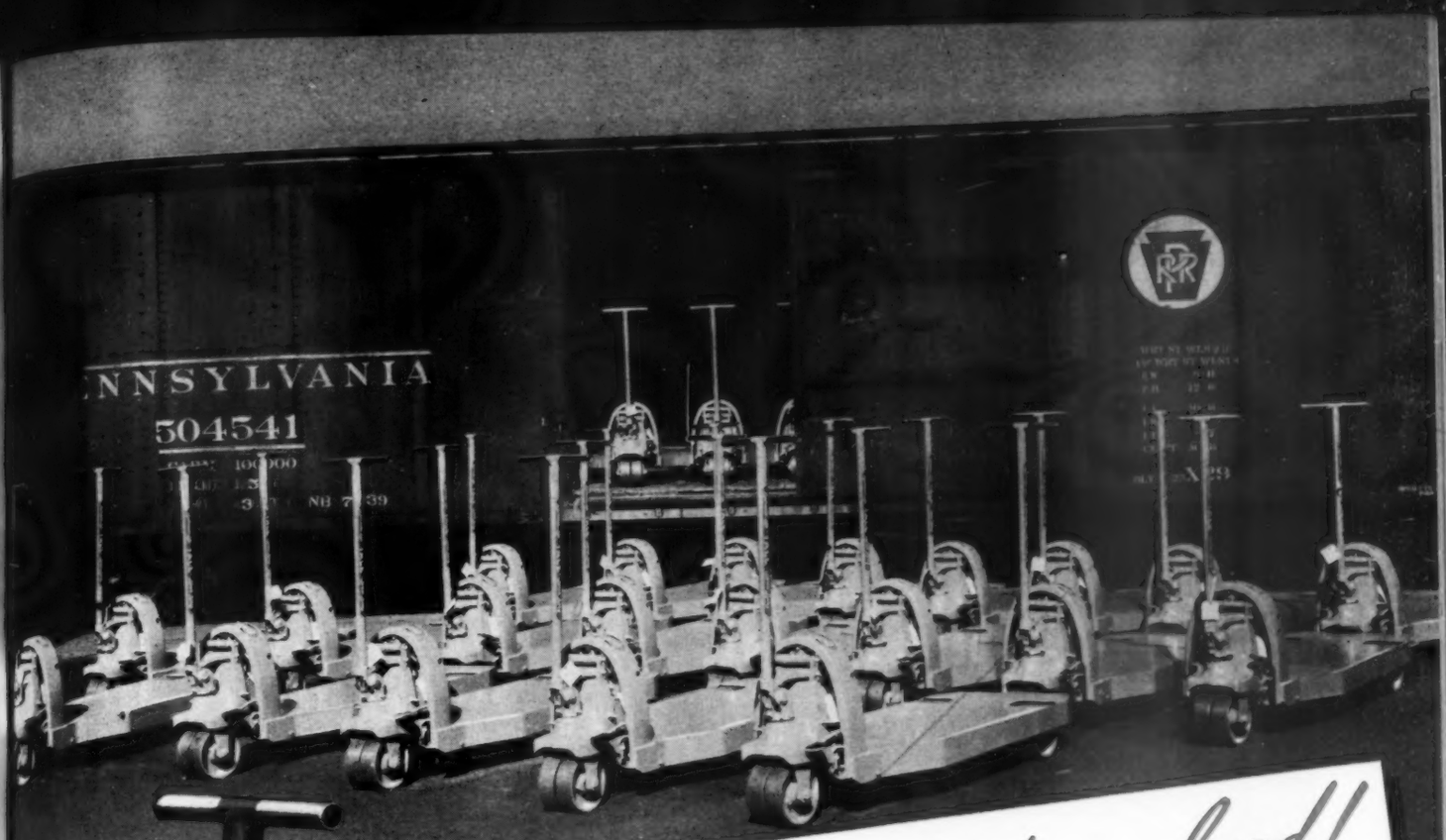
sizes are available. Opening through the rear enables the electrician to be sure the cable is deeply inserted into the lug. The lugs are equipped with socket headscrews and tightened with hexagonal head wrenches. The Trumbull Electric Mfg. Co., Plainville, Conn.

Flexible Coupling

Airflex coupling, designed for connecting diesel, oil, gasoline, or gas engines to any type of driven machinery, can be used with motor-driven compressors, single-cylinder pumps, and other driven equipment of a similar fluctuating torque nature. Consists of a resilient rubber gland lined with a pre-molded, pre-vulcanized, cylindrical section treated to prevent air loss and covered with multiple alternating layers of tough durable fabric and live rubber. The entire gland is bonded to steel inner and outer rims. Rubber-covered metal cap prevents entrance of foreign material into the valve. Degree of elasticity of the coupling can be varied by changing the air pressure. Available in six standard types. The Falk Corp., Milwaukee.

Timer

Model 75 electronic tube-type timer is designed to eliminate the necessity of an air or hydraulic pressure switch in resistance welding and to provide accurate timing control for any air-operated, stationary or portable, single or multi-spot welder. Four adjustments required are "squeeze" time, "weld" time, "hold" time, and "off" time. The squeeze time is the interval between the instant the initial welding pressure is applied and the welding current is on, thus allowing sufficient time to permit full welding pressure to build up before welding current is applied. Compensates for effects of lowered room temperatures or extreme distance from pres-



NATIONAL DEFENSE ★ ★ ★ ★ ★ ★ *by the carload!*

It's unusual when a story of success can be told at the end of 60 days. But, nation-wide acceptance in two months is the story of the new Yale "Load King" Hydraulic Lift Hand Truck.

In this "pre-planned for service" hand lift truck, manufacturers in all types of industry saw a materials handling tool that would help maintain the flow of materials, that would cut costs, that would increase the safety and efficiency of handling operations.

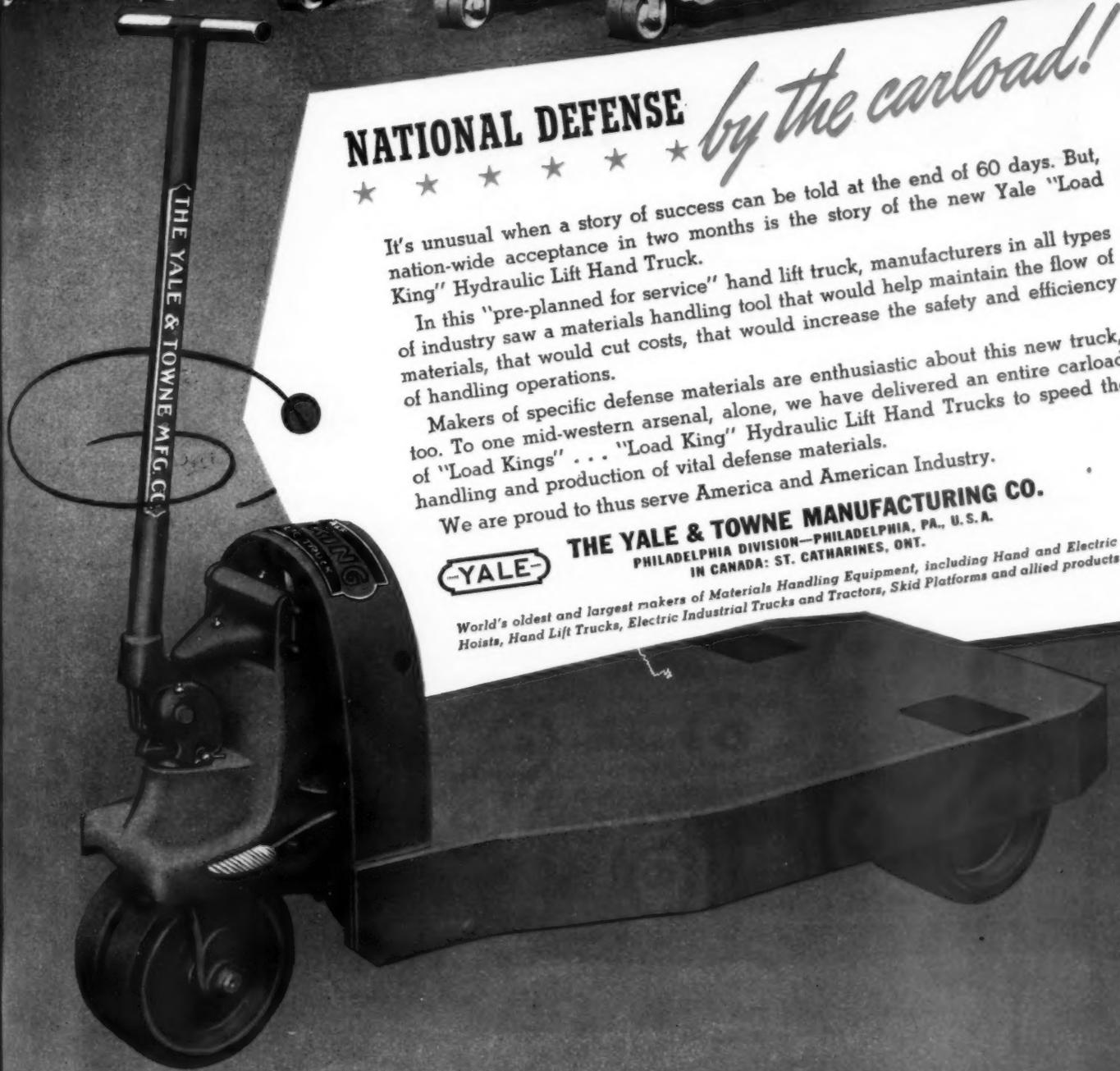
Makers of specific defense materials are enthusiastic about this new truck, too. To one mid-western arsenal, alone, we have delivered an entire carload of "Load Kings" . . . "Load King" Hydraulic Lift Hand Trucks to speed the handling and production of vital defense materials.

We are proud to thus serve America and American Industry.

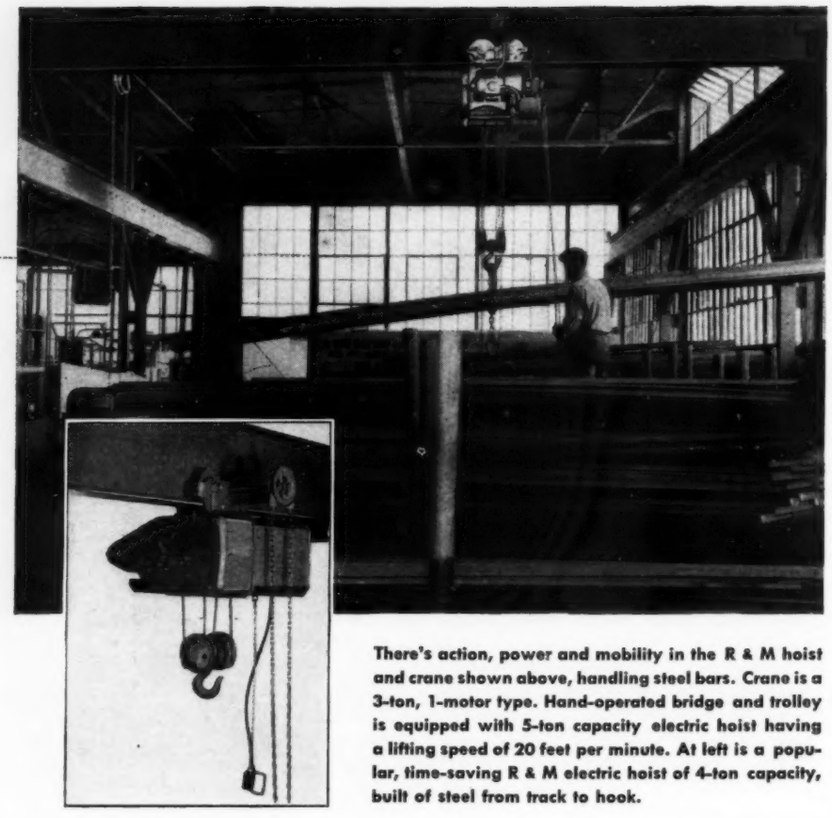
THE YALE & TOWNE MANUFACTURING CO.
PHILADELPHIA DIVISION—PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

-YALE-

World's oldest and largest makers of Materials Handling Equipment, including Hand and Electric Hoists, Hand Lift Trucks, Electric Industrial Trucks and Tractors, Skid Platforms and allied products



"Take it up" WITH R & M



There's action, power and mobility in the R & M hoist and crane shown above, handling steel bars. Crane is a 3-ton, 1-motor type. Hand-operated bridge and trolley is equipped with 5-ton capacity electric hoist having a lifting speed of 20 feet per minute. At left is a popular, time-saving R & M electric hoist of 4-ton capacity, built of steel from track to hook.

"TAKE it up" with R & M has become the economy byword in hoists and cranes for all types of industries. Here's one of many actual case records, for instance:

Production had to be stepped up in a leading midwestern machine-manufacturing plant. More skilled help was added . . . more equipment installed. Still, output lagged.

An R & M expert, working with the plant engineer, spotted the trouble. Old-type chain hoists were sapping man-efficiency, log-jamming heavy castings and steel bars all along the line. Three R & M hoists were installed . . . and here's what the cost chart shows:

- **R & M hoists are handling material 80% faster.**
- **Man-efficiency has shown a decided increase due to less muscle strain and fatigue from chain-hoist lifting.**
- **Not one dime has been spent for maintenance or repairs . . . not one minute lost in service since the hoists were installed.**
- **The R & M hoists paid for themselves within six months in savings made and in increased output.**

R & M has a *profitable* solution for your hoist and crane problem. Two thousand standard types are offered, from ¼-ton bantams to 10-ton huskies. And if none of these fits the job, we'll build one that *does*.

Phone the nearest R & M sales and service office listed in your classified telephone directory. Or write factory direct for further details. It will pay you to "take it up" with R & M.

ROBBINS & MYERS, Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878

sure switch to welder. Range of time selection is from 2–30 cycles. The timer is available for use with a magnetic or ignitron tube contactor and is standard for 110-volt 60-cycle operation. Weltronic Corp., 3063 East Outer Drive, Detroit.

Step-Type Valve

For chemical and proportioning pumps. A removable coverplate makes it possible to get quickly to all valves, ballchecks, and valve seats without dismantling the piping to and from the pump. The valve, it is said, will automatically discharge all air and eliminate air binding, will discharge small particles of dirt. Valves of this type will be available with various pumps for handling acids, alkalis, boiler-treating chemicals, oil-refinery products, and other liquids against pressures up to 20,000 lb. or more per sq. in., also on proportioning pumps and pumps with valve bodies made of transparent plastics. Milton Roy Pumps, 1311 East Mermaid Ave., Philadelphia.

Electric Polishers

Two polishers, for cleaning and polishing metal and removing stains or heat tint caused by welding, operate at 600 r.p.m. No. 182 is a dual-purpose tool—can be used as a polisher, or a drill chuck can be attached in place of the Arbors to make a ½-in. drill. Arbors for two or four brushes are available. Both types are equipped with universal motors for a.c. or d.c., 110, 125, 150, 220, 230, or 250 volts. The Stanley Works, Stanley Electric Tool Division, New Britain, Conn.

Corrugated Floor Runner

Available in rolls 36 in. wide and 30 ft. long, this runner is said to be non-skid, resilient, waterproof. It is a ribbed composition material of rubber-like appearance and is suitable for use in halls and on floors where a protective covering is necessary. The Philip Carey Co., Lockland, Cincinnati.

Distribution Transformers

Designed for direct pole mounting, these transformers eliminate extra accessories. Standard bushing and hanger arrangements allow interchanging of all makes and ratings. Features include a simpli-

KOOLSHADE* SUN SCREEN Puts This Whole Building In The Shade!

. . . AND SUN HEAT THROUGH WINDOWS IS CUT AS MUCH AS 85%

• Allegheny Ludlum Steel Corp., Chicago, Illinois

Comparative tests in this building demonstrated that KOOLSHADE Sun Screen kept offices as much as 15 deg. cooler!

The Allegheny Ludlum Steel Corp. offices are not mechanically cooled but the tests this company made prior to installing KOOLSHADE show what remarkable summer comfort results from merely *keeping sun heat outside!* Repeatedly on sunny midsummer days, an office equipped with KOOLSHADE stayed 10, 12 or 15 deg. cooler at peak load hours than a room without outside shade. In a similar test conducted by a large automobile company in Michigan, KOOLSHADE maintained a temperature approximately 14 deg. lower from 3 P.M. to 6 P.M. on an August day. Industrial executives and engineers will find in these tests practical proof of KOOLSHADE value in preventing hot-weather discomfort.

• *Your plant may not have Air Conditioning... but you can have the new comfort of* KOOLSHADE *"Sun Conditioning"! There are* KOOLSHADE *Distributors in all principal cities of the U. S. (In Eastern Canada, distributed by Creswell-Pomeroy, Ltd., Montreal.)*

Ingersoll **KOOLSHADE*** **SUN SCREEN**

"It's Cooler in the Shade!"

* Trade Mark . . . Property of Ingersoll Steel & Disc Division, Borg-Warner Corporation

INSTALLED LIKE ORDINARY SCREENS—KEEPS OUT INSECTS, TOO.

• Interior, Allegheny Ludlum Steel building —showing that KOOLSHADE does not interfere with light, view or ventilation.

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Borg-Warner Corporation, Dept. O-5
310 So. Michigan Ave., Chicago, Illinois.

Please send your SUN HEAT DEMONSTRATION KIT (without charge) and also complete KOOLSHADE Sun Screen literature.

Name .....

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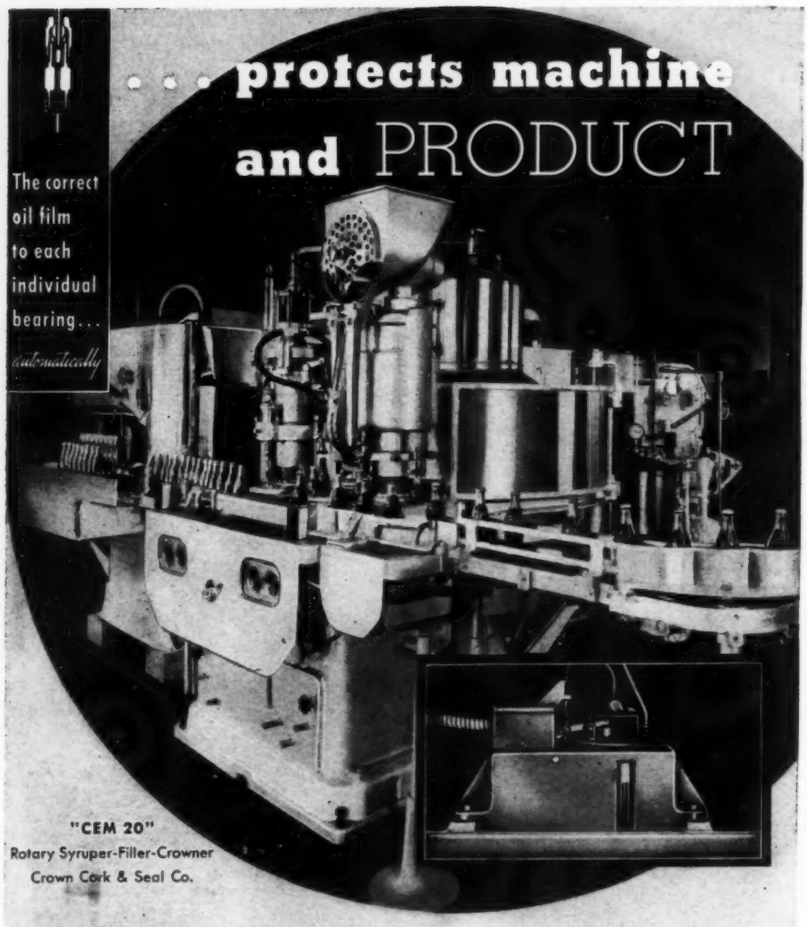
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The correct oil film to each individual bearing... automatically
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● Machine bearings need adequate lubrication at all times. In many cases, however, excess oil-feed might soil or contaminate product. BIJUR metered lubrication insures positive control under all conditions of operation.

The correct oil-film always!

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AUTOMATICALLY *Correct* LUBRICATION

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CHECK THOSE NEW MACHINE SPECIFICATIONS. THE BEST MAKES HAVE AUTOMATIC LUBRICATION.

1558

fied hanger lug for mounting, standard size and location of grounding pad and bushings, simplification of voltage ratings and tap arrangements, copper-bearing steel tanks spray-bonderized and tested under pressure to prevent rusting and leakage, impregnated core and coil construction with insulation for high resistance to current surges. Available in sizes 1½ to 25 Kva. up to and including the 15,000-volt class in standard voltages. Allis-Chalmers Mfg. Co., Milwaukee.

Welding Material

In April, 1940, the Park Sales Co., 3 Park Place, New York, introduced a welding material made in Switzerland. As the material can no longer be imported, the company is now making a similar product selling under the name of Weldoloy. It is available in a variety of alloys and fluxes for oxy-acetylene welding and is said to permit welding at unusually low temperatures and thus avoid overheating and subsequent warping of welded parts. Weldoloy alloys are supplied in rod form and fluxes in powder or paste form.

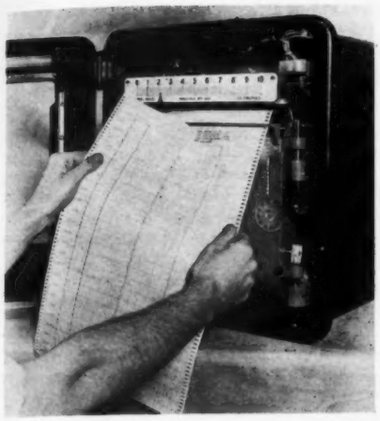
Power Shovel

For handling of loose materials. The machine may be used in foundries, chemical and fertilizer plants, and the like. It is built on a 3-wheel chassis with rear-wheel steer, is powered with a 4-cylinder motor, is said to be capable of 24-hr. con-

tinuous operation. Carrying a load up to 1,500 lb., it bulks as much as 18 cu.ft. at from 3½ to 11 m.p.h. and elevates its load in less than 10 sec. to dump it into carts, trucks, or bins. One model has 45 in. underclearance when dumped, another has 65 in. underclearance. Special equipment includes lights and a hopper lid that opens and closes automatically as driver picks up and dumps load. Clark Tructractor Division of Clark Equipment Co., Battle Creek, Mich.

Tear-Off Device for Strip-Chart Recorders

Enables users of Micromax strip-chart recorders to tear off and file a record of each day's operation. It is easily attached and when used it is not necessary to rethread the chart through the guides. It eliminates chart wastage and makes it possible to file daily strip-chart records. A



rubber stamp can be furnished which identifies the recorder and location of the thermocouples. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia.

Cylinder Truck

Hand truck designed to carry an oxygen cylinder, an acetylene cylinder, and a complete welding and cutting outfit is known as the Oxweld T-7, 2-wheel, welding truck. It is light in weight, has 14-in. wheels equipped with semi-pneumatic tires, and is easy to maneuver. The Linde Air Products Co., 30 East 42nd St., New York.

Transformers

The Noflamol transformers are filled with a non-inflammable synthetic liquid developed to permit installation of the transformers indoors without use of fireproof vaults, and in places where regular oil-filled transformers would constitute a fire hazard. They can be installed on beams near the ceiling and in other out-of-the-way places. Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.

Duplex Tubing

Bi-metal tubing for severe corrosion conditions is constructed with an inner tube of one metal or alloy and an outer tube of a different metal. It is used where tubing is subjected to two different types of corrosive attack. The new tubing consists of copper outside and steel inside and is applicable for piping illuminating gas in soil exceptionally corrosive to steel. Other combinations for various uses are available. Tubing can be made up to meet individual specifications. Bridgeport Brass Co., Bridgeport, Conn.

Respirator

No. 94 Healthguard respirator, for protection against Type A (silica) lead and nuisance dusts, features a soft-molded rubber facepiece which fits low on the nose, eliminates obstacles to vision, and permits the user to wear spectacles or goggles with the respirator. The metal filter box guards replaceable filters with an over-all filtering area of approximately

YOUR PLANT PHYSICIAN SHOULD HAVE OUR NEW BOOKLET

Burned up energy slows the work just as certainly as burned out buildings do . . . and it often takes longer to repair personnel than to repair property.

Nutritional anemia, one of the common causes of reduced employee energy, can be directly responsible for costly mistakes, spoilage, sub-standard work and constant waste of time and materials.

This insidious condition is particularly prevalent among women workers, a group which increases as the government's draft demands call your able-bodied men to the colors. Periodic blood loss in the menstrual cycle, food fads, and reducing diets make women natural targets for a disease directly traceable to faulty food habits as well as undernourishment.

Your plant physician can bar the door against this saboteur by simple preventive, as well as corrective measures. Iron in the blood is necessary to carry oxygen to body tissues. A low level of iron utilization, resulting in energy-sapping nutritional anemia, can be combatted quickly and effectively by administration of Foundation-licensed Copper-Iron Compounds, in which the presence of copper permits quicker and more complete utilization of the iron in building hemoglobin and restoring energy.

We shall be glad to send your plant physician full details, authoritatively documented, of the benefits to be derived from the use of copper with iron in treatment of secondary and nutritional anemias. Just return the coupon below, giving us his name.

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Approved for COPPER-IRON upon periodic tests

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Please send our Plant Physician all available information on modern treatment of nutritional and secondary anemias. F-531

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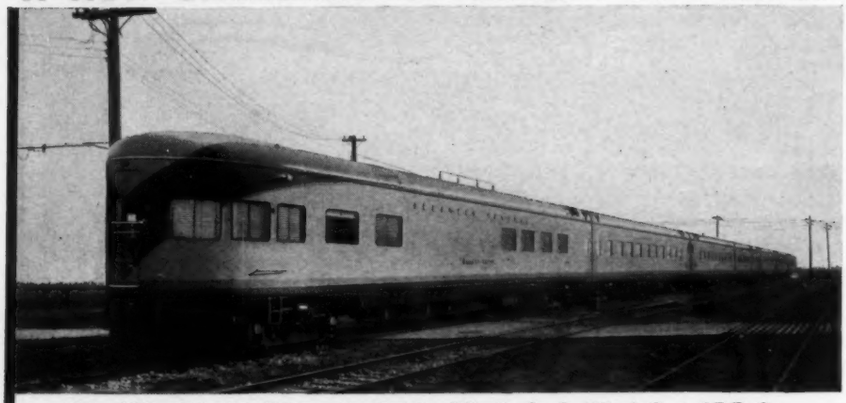
A NEW STANDARD OF BEAUTY IN TRAVEL



"City of Miami" built by Pullman-Standard Car Mfg. Co. for the Illinois Central R.R. Co. This train operates between Chicago and Miami in 29½ hours.

And the Construction

-AIDED BY *EC&M* WELD TIMERS

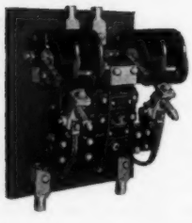
IS *Equally* OUTSTANDING!

PASSENGERS marvel at the exceptionally beautiful interior of this crack streamliner, "City of Miami." In achieving it, Pullman utilized craftsmanship of a high order.

A portion of the interior steel is joined by welding—using EC&M Weld Timers—thereby obtaining strong, *perfectly formed* joints without indentation and discoloration of the material being welded.

There's no guesswork with EC&M Weld Timers. Timing is *completely automatic.* Strong, uniform welds result. And, in addition, this accurate timing, by safely permitting higher welding current, saves welding time!

In welding stainless steels, galvanized metal, non-ferrous metals, sheet steel, etc., EC&M Weld Timers give outstanding results in both quality and quantity of work. Ask for descriptive Bulletin 1201, also for Booklet 141—a guide on welding procedure for operators.



● As companions for these Timers EC&M has a complete line of Heavy-duty, Fast-operating Welder Contactors to handle the main welding current. They are mechanically sturdy for this exacting service and very efficient. Ask for Bulletin 1211 describing them.

The Electric Controller & Mfg Co.
2700 E. 79th St. Cleveland, Ohio

E&M

Look for this Trade-Mark when you buy — specify it when you order

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

40 sq. in. Exhale valve incorporates a speaking diaphragm to permit normal exchange of conversation. Chicago Eye Shield Co., Dept. 10, 2362 Warren Boulevard, Chicago.

Air Conditioning Unit

For window mounting, Type 51C Room Weathermaker is ideal in offices. Said to have a cooling effect of approximately 5,700 B.t.u. per hour. A 3-position switch controlling operation of the unit makes it possible to use it for ventilating, filtering, and circulating air when cooling and dehumidifying are not desired. The compressor motor is ½ hp.; fan motor, 1/80 horsepower. The mar-resistant baked enamel casing is said to resist cigarette burns or beverage stains. Carrier Corp., Syracuse, N. Y.

Food Service Truck

Built for plant use, this truck can carry several hundred pounds of bottle goods, ice, and food. A 14-gage plate ties the frame together across the bottom. Wheels are mounted directly to the frame. The 22-gage panel covering the outer portion is replaceable. The end waste compartments are removable for emptying and cleaning. Truck itself consists of a hot food section, a bottle goods compartment and

an ice cream cabinet, two lower storage compartments, two waste containers, six cold sandwich and pie compartments, one large pastry display, one tobacco and cigarette display; one coffee urn holding approximately 8 gal. equipped with creamer. The hot food compartment has four porcelain enamel strip heaters, each with a rating of 500 watts. The coffee urn compartment is heated with a Calrod unit of 1,000 watts rating. The trucks are furnished for either 220 or 115 volts. Kay-Zee Mfg. Co., 5201 Denison Ave., Cleveland.

Cooling Thermostat

Demand-compensated cooling thermostat, for use in controlling unit room coolers, central plant coolers, and individual zones in zone systems, does not use outdoor compensating elements in maintaining proper indoor temperatures. Heater element within the instrument produces a difference in temperature between the thermostat in the room which varies in-

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.. AND HOW TO BUILD THEM

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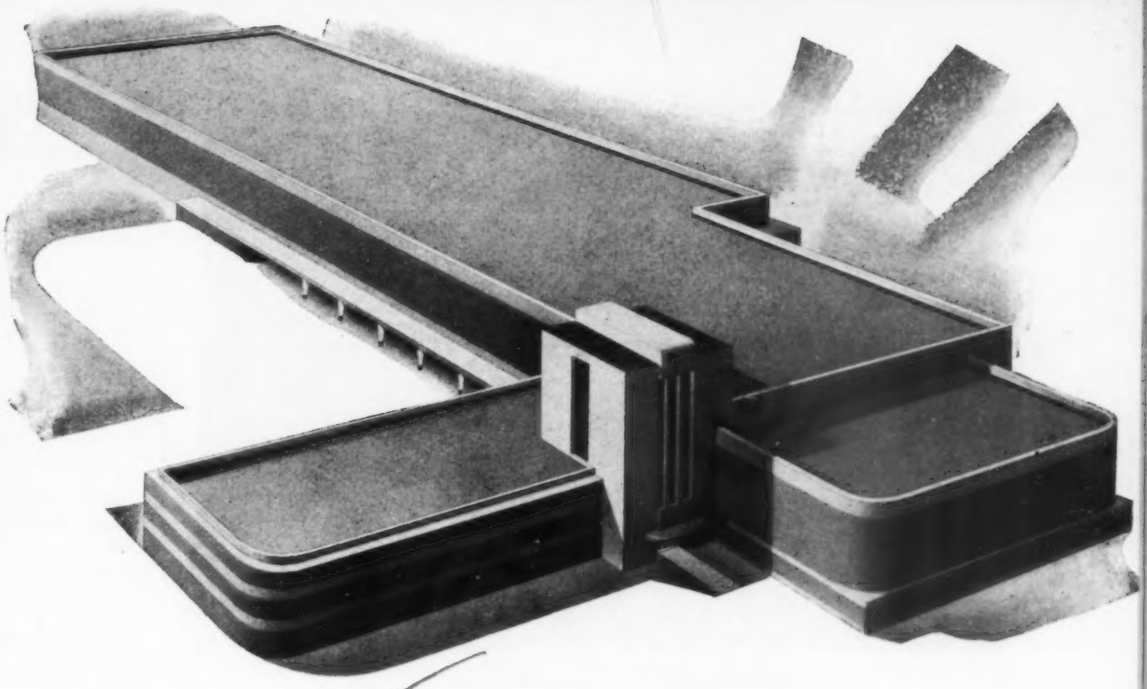

BLACK OUT plants prove again why you should "stick to tar"

Koppers technical representatives have worked closely with architects and with contractors in the development of roofing and waterproofing for windowless factories of the "black-out" type, and for waterproofing of structures which must be kept underground for defense reasons.

Windowless factories require water-cooled roofs to make the air conditioning less costly. Water-cooled roofs permit the use of smaller refrigerating units, which cost less to purchase and which use less electricity. We will be glad to send you the report on Koppers Water-cooled Roofs.

Structures which are built underground, with a soil covering or backfill, must be protected from moisture penetration and corrosive substances which cause deterioration of concrete or masonry. Coal tar pitch is not adversely affected by sub-soil conditions and Koppers Coal Tar Waterproofing Pitch and Tar-Saturated Rag Felt is practically a "lifetime" material under those conditions. Send for the Koppers data sheet on membrane waterproofing.

KOPPERS COMPANY
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KOPPERS COMPANY, 1223 Koppers Building, Pittsburgh, Pa.
Please send me copies of these folders:

- ☐ "Steep Roofs of Coal Tar Pitch"
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- ☐ "Dampproofing"
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- ☐ "D-H-S Bronze"

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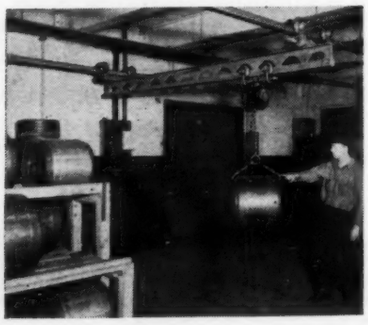
Hand-propelled Cleveland Tramrail crane with electric hoist. Available with rope or pendant push-button control.

MAKES A HARD JOB EASY

—and pays for itself in savings of time

Illustrated above and below are short-span hand-propelled cranes with manually-operated chain hoists. Two-runway cranes are available for capacities of 3 tons, 45-ft. span and 5 tons, 25-ft. span. Longer spans may be covered with cranes operating on three, four, and more runways. Other type cranes available for heavier loads.



To handle heavy boxes and cumbersome materials by hand is a hard job that often can be done in a fraction of the time by a simple, easily-operated Cleveland Tramrail crane.

With the use of an inexpensive hand-propelled crane, materials can be delivered to or withdrawn from stock by one stockman without assistance. Such a crane equipped with an electric hoist is easier and much faster in operation. Time saved usually will pay for an installation in a short period.

Cleveland Tramrail cranes and carriers are easy to operate — only 15 pounds starting effort and 10 pounds running effort are required per ton load.

These cranes are available in every type from straight hand-power to completely electrified cranes. By means of interlocks and discharge points they may be connected with overhead rail systems, permitting loads to be conveyed to other departments or onto other cranes.

Whatever your overhead materials handling problem, Cleveland Tramrail is ready to serve you. Competent representation in 60 cities in the United States and Canada.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1187 East 283rd St. Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT
Other products: CLEVELAND CRANES and STEELWELD MACHINERY

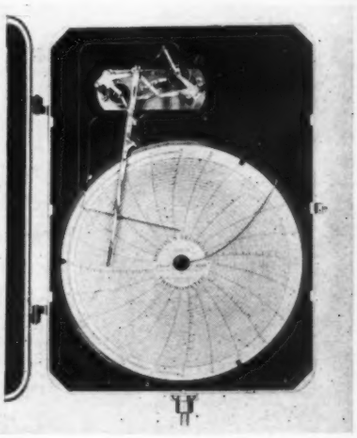
versely with the percent time on the cooling equipment. This makes possible an automatic and gradual increase in the instrument temperature setting from 72-80 deg. F. as outside temperature rises to a point where cooling equipment would normally run full time. Electrical ratings: 2 amp. at 25 volts, and 2 amp. at 110 or 220 volts when used with adapter assembly. Weighs 5 oz., measures 4⅛ by 2¼ by ⅞ inches. General Electric Co., Schenectady, N. Y.

Diffusing Strips for Fluorescent Lighting

P-F-C plastic diffusing strips in 12- and 24-in. lengths are available for any fluorescent lighting installation where 1½-in. lamps are used in open-type fixtures. Said to reduce lamp brightness 30 percent yet transmit more light than glass panels. They are made of shatter-proof plastic and snap on and off. Available in white, pink, or yellow. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis.

Recording Thermometer

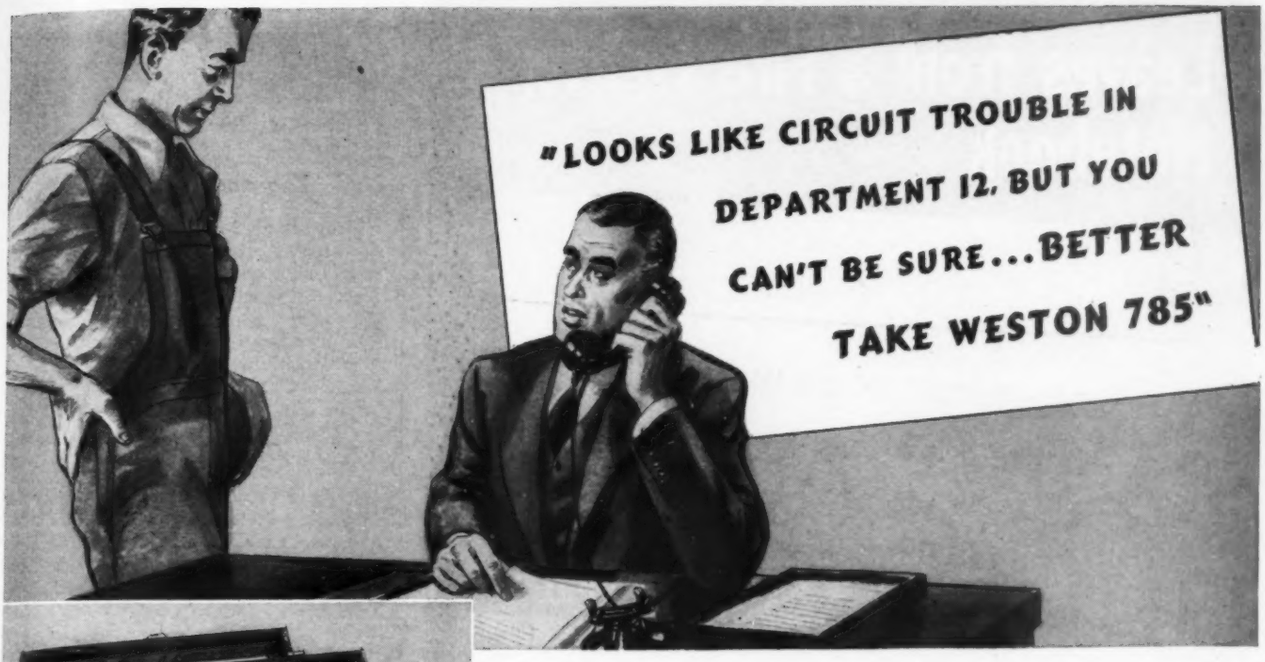
Liquid-filled type. Case-compensated Class 1 recording thermometer is available



in ranges up to 400 deg. F. and tubing lengths up to 10 ft. or longer depending on conditions surrounding the installation. Fully compensated Class 1 recording thermometer may be had in ranges up to 400 deg. F. equipped with 200 ft. or less of connecting tubing between instrument and bulb. The Bristol Co., Waterbury, Conn.

Riser-Cutting Gun

Line of hand-cutting apparatus consists of two torches and three tips and is for use in removing riser heads from metal castings. Styles 3180 and 9030 are straight-head type with monel metal heads and stainless-steel tubes for longer life. Each is 21 in. long. Cutting oxygen can be controlled by lever or trigger. Type selected can be placed on top, either side, or on bottom of torch to suit the operator. Cutting tips—Style 187 bent to 75 deg., Style 181 bent to 90 deg., Style 191 is straight tip and 7 in. long. Shorter length from end of tip to bend makes possible greater maneuverability in restricted areas



WESTON MODEL 785
Industrial Circuit Tester

VOLTAGE RANGES

DC Volts—0-1/10/50/200/500/1000 volts—20,000 ohms per volt

AC Volts—0-5/15/30/150/300/750 volts—1000 ohms per volt

CURRENT RANGES

DC Current—0-50 microamperes, 1/10/100 milliamperes, 1 ampere and 10 amperes

AC Current—self-contained ranges 0-.5/1/5/10 amperes. (Higher ranges with an external current transformer.)

OHMMETER RANGES

0-3000, 0-30,000, 0-300,000 ohms, 0-3 megohms, 0 to 30 megohms (self-contained batteries).

...this one *multi-purpose* instrument handles 90% of plant emergency calls!

Here's a maintenance chief who handles "trouble" in an efficient, practical manner. True, he has a complete set of standard WESTON electrical instruments for periodic maintenance checking. But on emergency calls, where quick action is needed, and where the cause of the trouble is unknown, he uses the WESTON Model 785 Industrial Tester... a multi-purpose instrument with voltage, current and resistance ranges specifically for this service. For with the compact Model 785 alone, he can check motor and control circuits... lighting circuits... sensitive relay circuits... and even communications and electronic circuits. And in addition to wide adaptability, Model 785 also provides the ruggedness and dependable accuracy which is typically WESTON. Remember, too, that Model 785 is but one of many time-saving, cost-cutting, *multi-range, multi-purpose* instruments in the WESTON line. Why not have all the facts? Phone your nearest WESTON representative, or write to... Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

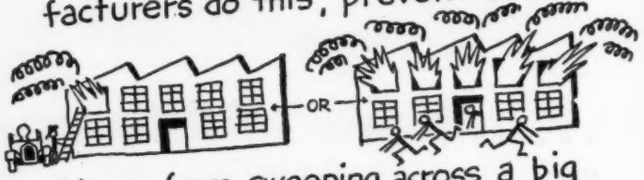
WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 52 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Leaves from a Fire Fighter's Notebook

FIRE PROTECTION ENGINEERS like to see operations broken up into separate rooms or buildings, whenever feasible. Explosives manufacturers do this, prevent small



blaze from sweeping across a big factory floor, involving entire plant.

SABOTAGE has everybody scared. You must protect against both accidental and planned fires.

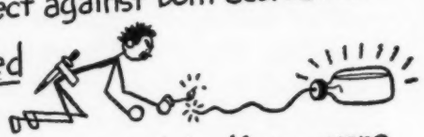
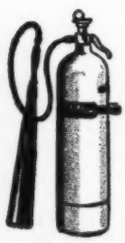


Figure what you would do, if you were a saboteur. Could anyone else get away with it? Are all hazards guarded with proper extinguishers?

The above fire fighting facts have been prepared with the assistance of the National Fire Protection Association.

HEAVY penetrating power adds fire-killing punch to LUX extinguishers. When LUX carbon dioxide gas roars out of the nozzle, it is expanding to 450 times its former stored volume. Fast expansion drives LUX gas past obstructions, around corners . . . to kill fire wherever it lurks. Especially electrical and flammable liquid fires.



This is one of a series of advertisements discussing industrial fire protection. Reprints will be sent on request.

LUX
SNUFFS OUT FIRE

Walter Kidde & Company
INCORPORATED
512 West Street, Bloomfield, N. J.

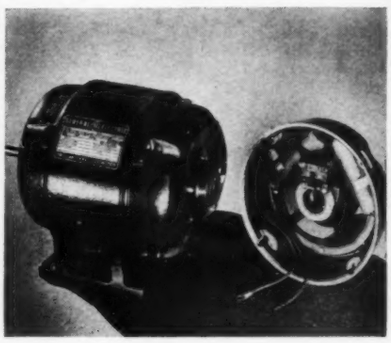
and cramped quarters. May also be used for removing rivets, for repair jobs, for regular and special applications as standard hand torches. Air Reduction, 60 East 42d St., New York.

Keg and Case Truck

Made from 1-in., square, high-carbon steel tubing, the truck measures 46 in. long, has a nose 14 in. wide and 7 in. deep. It weighs 30 pounds. The two wheels are 6 in. diameter. Available with plain or roller-bearing semi-steel or rubber-tread wheels. Bond Foundry & Machine Co., Manheim, Pa.

Capacitor Motor

Tri-Clad capacitor motor, featuring mechanical and electrical protection in addition to protection against operating wear and tear, is available with either ball-bearing or sleeve-bearing construction. Type KC is for applications requiring moderate starting torques—fans, blowers, centrifugal pumps. Type KCJ is designed for compressors, loaded conveyors, reciprocating pumps, and other applications requiring high starting torque. The capacitors



are mounted inside the end shield on the normal-torque motor. On the other, 1½ hp. and larger, they are mounted in a case on top of the motor frame. Transfer switch transfers motor from starting to running connection; pressed-steel conduit box, may be mounted in four different positions, provides large working space and simplifies installation in close quarters. General Electric Co., Schenectady, N. Y.

Warehouse Truck

Equipped with a brake for safe operation, this truck serves to best advantage where floors are slightly inclined or material is brought down ramps. Brake may be employed in loading and unloading and for killing momentum of heavily loaded trucks. In braking, the lever located under the handle is pushed down. To release, the lever is pulled up quickly. Deck measures 36x72 in.; height from floor to deck is 19¾ in., from floor to top of handle is 38 inches. Large wheels in rear are 18x2½ in., rubber tired, revolving on 1x4-in. bearings. Small front wheels are 10x2½ in. swung in double ball-bearing swivel caster rigs. The Service Caster & Truck Co., 505 North Brownswood Ave., Albion, Mich.

Eyes That Keep Production Flowing

IT TAKES safe, keen eyes to keep an uninterrupted flow of products coming off the production line. And today, speed, efficiency and economy of production are vital to adequately meet emergency demands.

Eyes are safe from physical injury when they work behind Bausch & Lomb Safety Goggles. Eyes are keen when those goggles have B&L prescription-ground hardened lenses. Eyes are comfortable when those goggles are properly fitted.

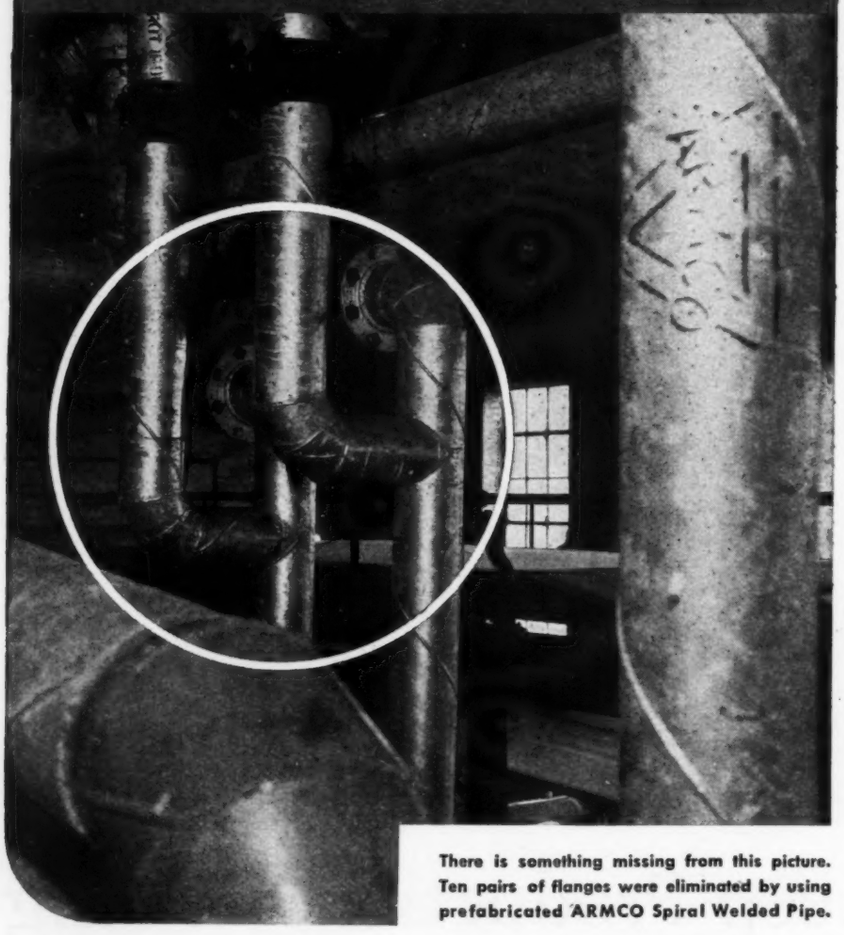
Backed by 88 years of experience in producing lenses and frames for eyesight correction, precision optical instruments for industry, science and education and optical equipment for military use, Bausch & Lomb Safety Goggles are optically correct. Their manufacture is completely controlled by Bausch & Lomb even to the raw glass which is made in the Bausch & Lomb Glass Plant.

The result of that optical experience and rigid manufacturing control is a complete line of safety goggles that will lower eyesight injury costs and help to maintain production schedules and product quality. Bausch & Lomb Optical Co., 693 St. Paul Street, Rochester, N. Y.

BAUSCH & LOMB

Safety Goggles

$68 SAVED HERE



There is something missing from this picture. Ten pairs of flanges were eliminated by using prefabricated ARMCO Spiral Welded Pipe.

A dollar saved is a dollar earned . . . One mill recently eliminated ten pairs of flanges and saved $68.00 on just two small fittings by using prefabricated Armco Spiral Welded Pipe. This was only part of the installation. Costs were lower all along the line.

Every foot of Armco Pipe was custom-built to fit the job. Tees, wyes and elbows were made to measure and welded to straight pipe runs. This saved at least one pair of flanges at every bend and greatly simplified assembly.

Armco Pipe also gives years of high operating efficiency. Fewer flanges mean fewer joints, less chance for leaks. And "Spiral Welded" has no threads to weaken the metal and invite corrosion.

You can make similar worthwhile savings by using Armco Spiral Welded Pipe on that next job. Diameters range from 6 to 36 inches, wall thicknesses from 7/64 to 1/2-inch. Send us your plans; we'll submit a cost estimate and sketch of our proposed design. The American Rolling Mill Co., 1431 Curtis St., Middletown, O.

ARMCO

ARMCO SPIRAL WELDED PIPE

Storerooms On The Move

(*Continued from page* 63)

In gear cutting, both for the ring gear and pinion, we are dealing with a battery of machines all doing the same operation. However, in the facing operations, prior to the teeth cutting, we are dealing with a different problem—one machine has sufficient capacity to give the required production. To provide the same safety insurance against breakdown, a float must be provided here, but a conveyor between these facing machines with one operator running three of them would not be practical. This is how the problem was solved for ring gear machining. (Incidentally, this same solution is used in all roughing operations where adjacent machines are in sequence). The first operator runs three machines, the feeding point of all being within a radius of about three feet. His raw blanks come from the forge shop by truck, one of the three or four spots in the plant where this is done.

Connection between this first operator on rough facing and the second operator, who operates two machines, is made by an angle slide in three sections or layers, one above the other. The slope, from the first operator's loading and to the second operator's unloading end, is about 30 degrees. Bearing rollers attached to the angle iron members aid in moving the blank. The unloading end is about at working level.

Bank Between Operators

We have, then, provided for a bank or float between these operators—it rests on the sections of this slide. Of course, additional facing operations are required. The last operator hooks the blank on the unit or group conveyor which runs over the gear cutters, as described above. These slides are designed to fit the part to be moved, which is true for the type of hook provided on the group conveyor, but otherwise the principle of operation is exactly the same.

The relief of management from detail is frequently mentioned as one of the advantages of mechanical conveying. Perhaps enough has been said to indicate the extent to which our foremen are relieved of the detail of getting their output from one department to the next. Operators and conveyors take care of that, with stops at inspection points on the way. It is important to menion, however, that the same group conveyor is frequently used both for finished and for unfinished parts between two groups of processes. Scheduling is thus simpli-

Bassick

SILENT-STEEL TRUCK CASTERS

WHEREVER quietness with extreme ease of swiveling and rolling are desirable . . . combined with unusual rugged strength . . . these silent steel double ball race Bassick casters are the ideal answer.

Projection welding of ball race to the horn, and king pin to the top plate give extreme strength and durability—long life without parts loosening up and becoming sloppy in action.

Sizes 3", 4", 5", 6" and 8" with rigid casters to match.

One type from the complete quality line of Bassick casters for every class of service . . . from tea tables to ten ton trucks. Sold by leading industrial distributors.

THE BASSICK COMPANY • Bridgeport, Connecticut

Division of the Stewart-Warner Corp., Chicago, Ill.

Canadian Factory: Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

Now

AN INDUSTRIAL HAND CLEANER
OF A NATURE
JUST THE OPPOSITE
OF TRADITION

You are used to sand soaps, pumice grit, detergent alkalies—so used to them it probably doesn't seem possible that a powerful cleansing soap could really be gentle in action. That's where you're wrong. Here is one that will loosen the oiliest grime without any sand-scrubbing—or parching effect, either. Non-abrasive corn-meal absorbs the dirt and a special impregnation with lanolin-oil makes it different in action from anything you've ever known.

LANOKLEEN

in your washroom will give your men something to be enthusiastic about. They'll clean-up with less effort—and less damage to their hands. Whether you realize it or not, harsh caustic soaps don't help skin-health or working efficiency.

LAN-O-KLEEN is worth a lot in helping prevent dermatitis. Even one or two cases can run into a lot of money for compensation claims.

LAN-O-KLEEN is an economy product. Light and fluffy, a little goes a long way.

CLIP THE COUPON

WEST DISINFECTING COMPANY

42-16 WEST ST., LONG ISLAND CITY, N. Y.

Attention Dept. J

I am interested in your FREE TRIAL offer of a Dispenser and sufficient LAN-O-KLEEN to test out for 2 to 3 weeks in one department. Please get in touch.

Name of Individual.....

Name of Company.....

Street & City.....

fied, but special arrangements are needed to prevent a mix-up, and to prevent parts being removed at a process which has already worked upon the part.

Two devices are used for this purpose. First, hooks are painted different colors—an operator removes parts from one colored hook and hangs completed parts on a different colored hook. Second, and this is exemplified on the green gear conveyor running into and out of the heat-treat, or carburizing department, different colored flat washers, about 4 inches in diameter, are hung on the hooks with the completed work. These devices permit unit conveyors to be used both for unfinished and finished work without confusion.

I had no intention, in writing this article, of trying to cover all the multiplicity of operations required on the large number of individual parts that go into the assembly of axles and front-end suspension units, but only of describing the various principles used in conveyor operation. So far most of the attention has been devoted to the gear and pinion end of the plant. Although the same methods, in general, are used at the opposite end of the plant, the presence of platform assembly conveyors for rear axles, torque tubes, and front-end suspension units, illustrates a different function for unit or group conveyors.

Interesting Application

Of course, the use of sub-assembly conveyors to feed assembly conveyors is not new, but an interesting application is provided by the front wheel sub-assembly conveyor. Several parts lines, including knuckle supports, steering arms, hubs, and drum assemblies, are completed immediately adjacent to the travel of the front wheel sub-assembly conveyor. As these parts are completed, they are hung on the conveyor which runs, at operating level, adjacent to the platform conveyor for the assembly of the suspension units. As parts are needed, they are removed and added to the unit.

The same pattern holds true for the rear-axle assembly, but here the conveyor design and the arrangement of hooks are different, because the parts to be handled vary from those going into front-end suspensions.

To be sure, the capacity of these two platform conveyors is so calculated that two front ends are produced for each rear axle assembled. The first conveyor travels south, the second, north. They meet at the loading point for the 6,634-ft. conveyor that runs to the final assembly line. This conveyor moves over the roofs of two buildings, through another building, through a bridge over a city street, and through two bridges on company property, before it winds up at the

These are the Reeves— "SPEED-UP" UNITS

for getting more production out of the machines you already have

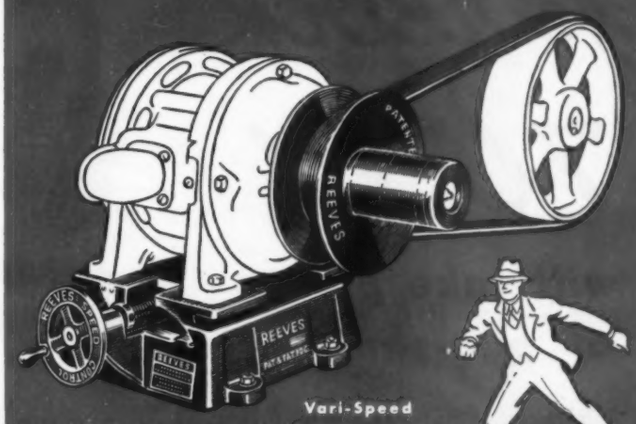
In thousands of American industrial plants management faces a grave problem. Old production machines are unequal to the new schedules imposed upon them—either because they cannot meet new demands for quality—or because they cannot keep up with the increased tempo of output which prevails throughout industry.

What these machines need is REEVES *Variable Speed Control.* Then they can be operated faster or slower—*at the exact speeds required* for more production, better production, or both at the same time.

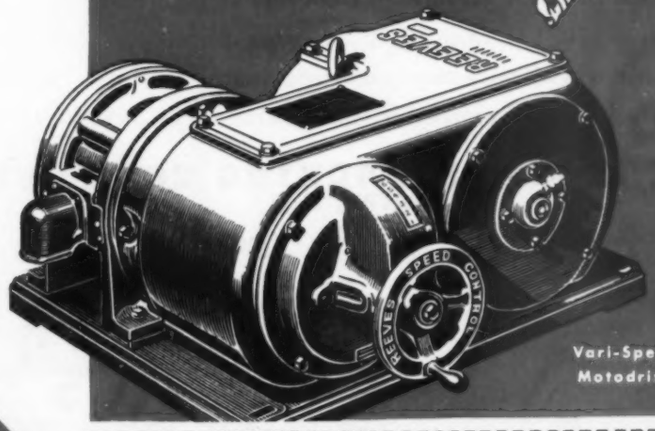
There are so many different models and sizes of REEVES Speed Control units available that it is a simple matter to select the exact size and type required. Units are built in open and fully enclosed models for horizontal or vertical mounting and for manual or automatic control.

Over 140,000 units now in operation, on all types of machines in all industries. You are buying *proved performance* when you install a REEVES.

Variable Speed Transmission



Vari-Speed Motor Pulley



Vari-Speed Motodrive

REEVES staff of seasoned speed control engineers will gladly assist you. Find out how inexpensively you can use REEVES Speed Control. Write for a copy of the new "Speed Up" book, which illustrates and describes 36 widely diversified examples of improved production through REEVES Speed Control units.

REEVES Speed Control

REEVES PULLEY COMPANY, Dept. F., Columbus, Indiana

Send free copy of booklet, "How to Speed Up Production with Variable Speed Control," describing and picturing 36 examples in all types of plants.

Name_____

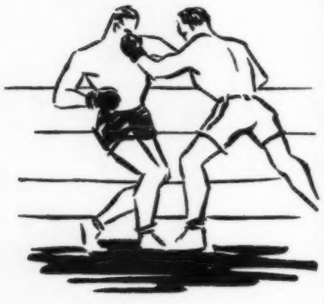
Company_____

Address_____

Garlock 7021

Thicknesses from 1/64" to ¼". Sheets 40" x 40" and larger.

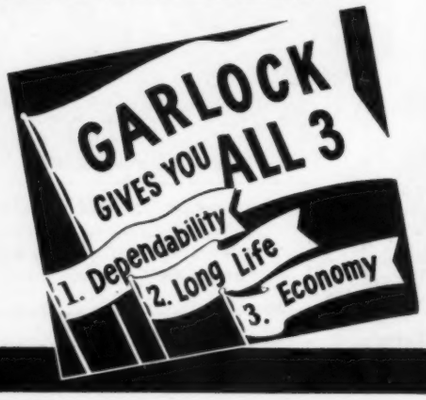
will take plenty of punishment!



UNDER the most severe conditions—such as super-heated high pressure steam and light oils at high temperatures—Garlock 7021 Compressed Asbestos Sheet Packing will *stand up* where ordinary gasketing materials fail. Avoid gasket failures and expensive shut-downs—use Garlock 7021.

THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.



final assembly line. But here again the same principle holds as with a unit conveyor in the axle plant—it connects two points and also carries a float. In this case a float prior to final assembly.

A word picture of this complicated set-up is difficult to draw, but the basic ideas underlying the design and arrangement of the 33 sets of unit conveyors stand out rather clearly. Perhaps a list will serve best as a summary.

1. Operators are not required to act as material conveyors.

2. Parts are delivered and removed at working levels, avoiding lifting by operators.

3. Transfers from one unit conveyor to another are done as a part of an operation or an inspect.

4. Conveyors serve as moving media and, at the same time, contain the float between groups of operations.

5. Scheduling flexibility is enhanced, for both unfinished and finished parts are hung on the same conveyor.

The result of the application of these ideas is manifest in that space is saved, for the floor is not a means of moving material. The shop is not cluttered, and no trucks are being driven noisily here and there to move material.

Control—With Two Pieces of Paper

(*Continued from page 67*)

stated the shipping date when acknowledging the order, this is noted and the purchase order copy is returned to the order progress clerk, who then posts a new shipping date and resignals the order. This method tells the purchasing department each day which items are delayed and enables it to follow up immediately.

When schedules are entered for receipt of materials, allowances must be made for contingencies. Past experience is generally used if there is no information as to time required to procure materials. The schedule clerk gets in touch with the purchasing department for the approximate time that must be allowed.

A duplicate copy of the purchase order received by the order progress clerk acts as the tracing copy. No writing of purchasing data is necessary on other forms as all information is available for the purchasing department.

The procedure for following the progress of production orders in the shop is similar. Daily production reports are received by the order progress clerk from the plant dispatchers. These

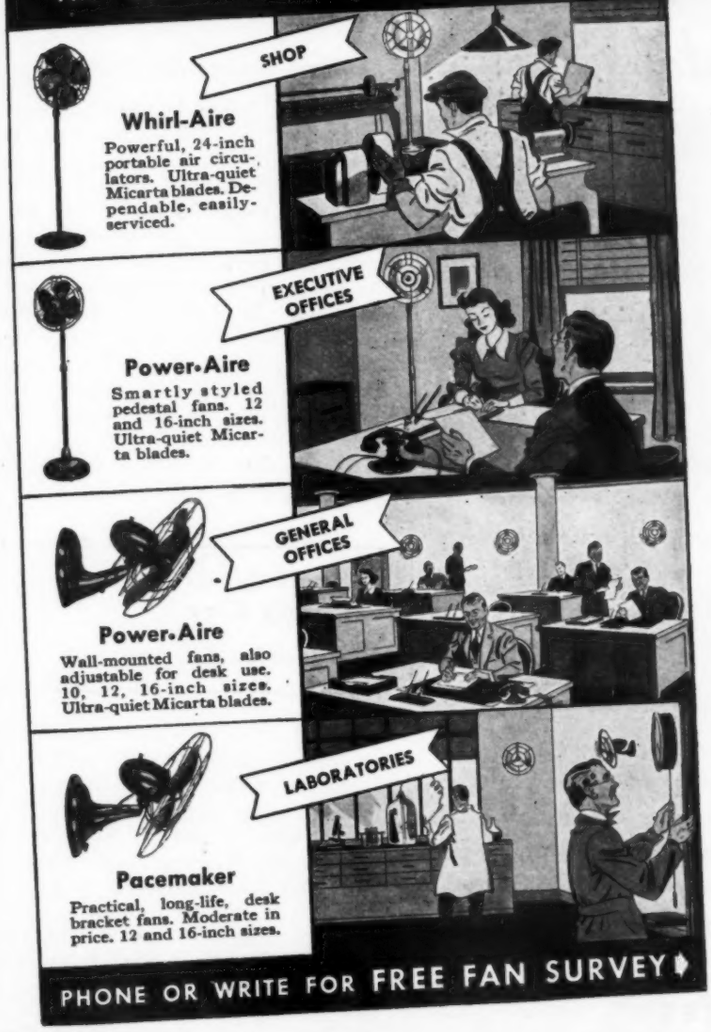
Don't let "HEAT FAG" cause PRODUCTION LAG

MEDICAL AUTHORITIES SAY:

Hot, sultry, dead air cuts down productive efficiency. Moving air is cooling, refreshing — increases vigor and alertness.

KEEP WORKERS ALERT, "ON THEIR TOES" WITH LIVELY AIR

THE RIGHT FAN FOR EVERY PLACE
THE RIGHT PLACE FOR EVERY FAN


SHOP
Whirl-Aire
Powerful, 24-inch portable air circulators. Ultra-quiet Micarta blades. Dependable, easily-serviced.
EXECUTIVE OFFICES
Power-Aire
Smartly styled pedestal fans. 12 and 16-inch sizes. Ultra-quiet Micarta blades.
GENERAL OFFICES
Power-Aire
Wall-mounted fans, also adjustable for desk use. 10, 12, 16-inch sizes. Ultra-quiet Micarta blades.
LABORATORIES
Pacemaker
Practical, long-life, desk bracket fans. Moderate in price. 12 and 16-inch sizes.

PHONE OR WRITE FOR FREE FAN SURVEY

You need it in your Shop, Offices, Laboratories

Workers who operate machines or perform exacting mechanical tasks, are especially susceptible to "heat fag." Keep them alert and refreshed with cool, refreshing LIVELY AIR from properly placed fans.

Likewise, in offices and laboratories, LIVELY AIR helps prevent fatigue and increases mental efficiency.

Why LIVELY AIR demands a Quality Fan

To provide LIVELY AIR for maximum comfort and efficiency, you need properly-placed fans with ample power to give *proper air* circulation at all times. You want *quiet, economical, trouble-free* operation for dependable cooling.

You need *Westinghouse Long-Life Fans*—recognized as the leader in quality fans for more than fifty years. Westinghouse offers a complete line of commercial fans suited to every need.

Phone your nearest Westinghouse Distributor, or write direct to Westinghouse Elec. & Mfg. Co., Dept. 1094, Mansfield, Ohio.

Westinghouse *Long-life* Fans

MEMBER OF THE LEISURE LINE OF ELECTRICAL APPLIANCES

Prevent Accidents with ANTI-SLIP WALKWAY MESH of Steelcrete Expanded Metal

ON CATWALKS, skywalks, platforms and stairways use Steelcrete Expanded Metal Walkway Mesh. It is safer not only to walk on but to work on. Tools cannot drop through its small diamond mesh openings. Skywalk mesh is similar to the Walkway Mesh, but has slightly larger openings. Both meshes are available in stock sizes, cut to size or fully fabricated. This stronger, fireproof material is better for many other uses throughout the plant. Steelcrete Expanded Metal can be made up quickly into economical partitions, shelving, window guards, machine guards, pipe tunnel covers and other necessities around your plant. A new 90 page Steelcrete handbook gives full details on this practical expanded metal fabric.

"IT'S WHEELING STEEL"

Listen to the Mill Whistle! Every Sunday 5 P. M.—EST
The Musical Steelmakers—Coast to Coast Mutual Broadcasting System

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses:
New York · Chicago · Cleveland · Pittsburgh · Philadelphia · Boston · Houston · Atlanta · St. Louis
Export Office, 330 West 42nd Street, New York, N. Y.

production reports are posted as soon as received. As soon as an entry is posted for completion of work in a department, the signal is moved for the next due date.

With this production control set-up, reports on an order are sent in to the production office from each department as soon as the work is completed, which gives this office up-to-the-minute information on the progress or state of each order. If, for example, the sales department or the customer requests information as to the status of an order, it can be given accurately in a matter of a few minutes. On orders for replenishment of stock items (if stock is depleted or the quantity in stock is less than the order calls for) the sales department may be given the scheduled completion date for the next stock order thus enabling it to give customer correct shipping information.

When Orders Are Delayed

Of course, delays do occur and must be provided for. When an order is delayed in the plant, the dispatchers re-schedule the order through the plant and send a copy of the new schedules to the head of the production department. As he knows the urgency of the order, he must approve the new schedules. If okay, the copy of the new or revised schedule is given to the order progress file clerk who changes the dates on the order and resignals for the first new due date. The okayed copy is then returned to the dispatchers, who are thus authorized to change the plant schedules.

Safety Is Up the Foreman's Alley

(*Continued from page* 70)

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plants. A white light burns as long as no accidents have occurred, but it turns to red when an accident happens. A similar sign is placed in the cafeteria of each plant, comparing the operating departments. A safety slogan, which is changed frequently, is a feature of all boards.

Safety committees are an important device for keeping safety education in the consciousness of supervision. A general safety committee is composed of all operating executives in a plant, and it is the function of each member to take care of day-to-day safety problems in their respective departments. This committee meets twice each month to consider action taken since the last meeting; new matters, such as checking the r.p.m. of revolving machinery, induced by the report just mentioned,

SKILSAW TOOLS
FOR EVERY JOB THAT NEEDS DOING!
THERE'S A SKILSAW TOOL
FOR EVERY OPERATION
• in Maintenance!
• in Production! • in Construction!
• Wherever men work, they work better, get more work done with SKILSAW TOOLS in the job. And they bring faster pro duction-day-after-day performance that makes men say, "These are tools you can depend on." Would you like to know why SKILSAW TOOLS are chosen so often, when careful men choose? Just test one yourself. In your own plant, and you'll see . . . and you'll keep on using SKILSAW TOOLS!
SKILSAW, INC., 5063 Elston Avenue, Chicago

Roof Coatings

Expansion Joints

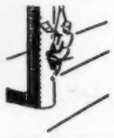
Insulated Roof Decks

Rock Wool Insulation

Built-Up Roofs

Corrugated Asbestos-Cement Roofing & Siding

Industrial Flooring


Hot Metal Paints

Air-Conditioning Equipment Housings

85% Magnesia Pipe Covering

All-Asbestos Prefabricated Duct

Waterproofing

defend YOUR BUILDINGS AGAINST FIRE AND WEATHER . . .

★ *Cut Maintenance To The Bone With*

Carey ASBESTOS AND ASPHALT

INDUSTRIAL PRODUCTS

CLEAR the decks for the main job — PRODUCTION. You can't afford at this time to be hampered by costly upkeep and inefficiency, either in buildings or equipment.

When you buy materials, buy on the basis of known performance, minimum yearly cost and maintenance. You get these definite results when you improve with CAREY materials.

CAREY Industrial Products cut costs from foundation to roof. They offer permanent protection against fire and weather . . . reduce heat losses . . . save fuel . . . prevent dampness . . . improve air conditioning . . . minimize maintenance.

CAREY materials are the development of over sixty years of manufacturing experience backed by extensive modern research and proving in the service of industry. Their use is insurance against costly experimentation. Write for new book—"Proved Protection Against Wasted Profits"—address Dept. 31.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

which call for action; and for the discussion of reported conditions in the plant in question. A monthly committee, a division of the general committee, is given charge of plant safety for one month. Two members are appointed to make a survey of the plant from the safety standpoint. This inspection is thorough. A printed report is prepared for the inspectors' use, which asks questions about the safety condition of all equipment in each department. The recommendations of these inspectors are considered in the meetings of the general committee.

From an analysis of our experience, it is evident that the new employee is not the only safety problem; older employees are involved as well. A check made last year indicated that workers with one year of service and over had the largest percentage of accidents. Certainly the totals in the two groups differ, but the results are sufficient to indicate the necessity for continually bringing home to all workers the necessity for safe working habits. Operating officials know that a safe plant is an efficient plant, and the degree to which they have been able, by leadership, by education, and by example, to inculcate the idea that a safe worker is an efficient worker, accounts for the rapid reduction in lost-time accidents within the last ten years. But, make no mistake about it, the operating supervisor is the medium by which results are accomplished, and safety affords him a way of approach to the worker where interests are mutual.

Learn To Talk and Like It

(*Continued from page* 73)

The wisdom of our plan was clearly shown by the remarkable attendance record that we had for our first semester. For the six-month period we had almost perfect attendance, except for absences due to illness, business trips, or other truly valid reasons.

The termination of our first year came in May, when we adjourned for the summer, but the pitch of enthusiasm was as high at adjournment as it had been on the night we first began. At the last session we resolved to reconvene in the fall, at the end of daylight-saving time. A final banquet was held, and the season ended in fine style.

During the first year our speeches (limited to three minutes) were confined to impromptu talks, readings, and a very few prepared presentations, which were assigned toward the end of the year. The main purpose of our first classes was to "break the ice," and let

From Assembly Line To Shipping Room BOSTITCHING Puts Them on TOP OF THE JOB

The Fastening Method—Key to Quicker, Profitable Assembly

In its effort to speed assembly without raising costs to unprofitable levels, industry is giving constant attention to the *fastening method* which will give the best results. In this connection, quite substantial savings have been reported through the use of the right stapling, tacking or wire stitching machine.

In the wood-working, automotive and metal-working industries, particularly good results have been obtained through "Bostitching"—named after the largest manufacturer of staplers and stitchers. Operator production raised 43% by stapling, instead of nailing or gluing . . . costs reduced 2/3 by stapling instead of sewing . . . are two out of many examples.

5 MACHINES PAY FOR THEMSELVES IN 50 DAYS

Nimble mechanical fingers of Bostitch staplers fasten burlap and padding to seat cushion springs, formerly assembled by hand. Total cost of 5 machines absorbed in less than 50 days.

Thousands of dollars have been saved when production executives discovered that motor-driven Bostitch machines can drive wire through steel 60 one-thousandths of an inch thick—at a machine speed of 295 per minute!

Common-Sense Advantages of BOSTITCHING

As well as considerable savings of time and money, the experiences of users prove that it is easy to select the right Bostitch machine, out of the nearly 800 models available . . . and, if desired, progress economically from smallest to largest through liberal rental, trade-in, or budget policies.

In addition, 18 Research Engineers, and over 300 representatives in more than 100 U. S., Canadian, and other cities specialize in fastening problems and are ready to adapt Bostitching to your needs. For further information, or case studies, write Bostitch, 60 Division Street, East Greenwich, R. I.

(Advertisement)

45% OF ASSEMBLY COSTS SAVED

"We saved 45% on fastening of upholstering and side covering on studio couches. The job was formerly done with hammer and tacks — now with Bostitch Stapling Hammers."

50% OF PACKING COSTS SAVED

"In packing our mattresses and studio couches, we saved 50% by using Bostitch staples instead of tape and twine."

Further facts and case studies will enable you to check *your* fastening efficiency—on the assembly line—in the shipping room—by finding out how much time and money Bostitching* can save for you. Write today! Send samples to be fastened, or describe your particular fastening or packing problem.

*BOSTITCHING — using the right stapling, stitching or tacking machine, and the exact size and kind of staple to get the most efficient fastening results.

SEND FOR FREE FOLDER

BOSTITCH

fastens it better with wire

STAPLING · STITCHING · TACKING

BOSTITCH, 60 Division St., East Greenwich, R. I.
(or Bostitch-Canada, Ltd., Montreal)

Send me free folder

- ☐ "Bostitch Fastens It Better with Wire"
- ☐ "Bostitch in the Shipping Room"

Name .....

Company .....

Address .....

My industry .....

9-41

"We want *Correct Lighting* —not bargains in fixtures!"

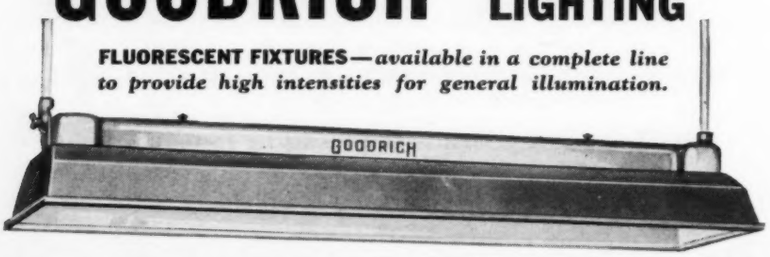
● That's right, Mister! And your electrical contractor will agree with you! When lighting fixtures are designed right, built right, installed right—they'll *stay* right! And they'll keep right on delivering the high quality illumination that you originally bought!

That's why Goodrich fluorescent fixtures are finished in permanent porcelain enamel . . . why they are made in accordance with R. L. M. standards . . . why they use certified ballast equipment . . . and bear underwriter's approval. These safeguards are your protection. They're important. Be sure to have them!

The Goodrich line covers the complete range of industrial lighting fixtures. Literature is available on all Goodrich fixtures.

GOODRICH INDUSTRIAL LIGHTING

FLUORESCENT FIXTURES—*available in a complete line to provide high intensities for general illumination.*



SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

those who had never spoken in public get used to standing on their feet, speaking their thoughts, and hearing their own voices.

On "opening night" one of our speakers got to his feet, opened his mouth, and stammered out that he couldn't think of a thing to say. He turned crimson with embarrassment and sat down. The marked improvement in the whole class is illustrated by the fact that this man is today one of our best speakers.

Our cooperative plan consists of the selection each week of a new chairman from the group, who conducts the following session, and, when impromptu subjects are not to be the order of the day, provides the topics on which the class shall speak. He introduces the speakers and gives a short comment on the individual subjects, but does not deliver a talk of his own. We believe that being chairman provides sufficient practice for any one session.

With the beginning of the semester last fall, a new plan of operation was introduced. We decided that sufficient time had been spent on groundwork, and that we had progressed far enough to warrant enlisting professional aid. So we obtained a copy of a nationally known textbook on public speaking. Each week one of the group was assigned a chapter of this book, which he reviewed at the following meeting.

Whoever studies a chapter and delivers a review at the class meeting automatically becomes chairman at the following session, and serves as critic. His comments are specially directed toward the points of public speaking that have been brought out in the textbook chapter he has reviewed. In other words, he is accepted as an authority on whatever points may have been covered—enunciation, stage manner, gesticulation, or manner of delivery.

We sincerely believe that other company groups will find that this plan will work equally well in their companies as it has in ours, and that they will find that their managements will cooperate 100 per cent in assisting them to promote their plan for self-improvement. General Electric Company has laid every facility at our disposal, and our way has been made easy, but even under less ideal conditions such classes can be formed and will provide wonderful personal benefits.

To speak well not only enhances your value to your employer, but, more important to you, it enhances your value to yourself. To increase your ability in self-expression expands your personality, increases your circle of friends, and brings with these advantages that feeling of assurance which is the prime requisite to success in any venture in life.

How to Get an All-purpose Power Cable IN A HURRY

Order TELLURIUM PARKWAY Right Off the Shelf

This is a 5000-volt tellurium parkway cable, with metal shielding tapes on conductors and with a ground wire. It is designed for mine power distribution, but it can also be used in other places where a very safe cable is required.

51 Items in Stock

Conductor Size, Awg

WITH VERSATOL	WITH 30% RUBBER
SINGLE-CONDUCTOR	
600 Volts	600 Volts
8 str	8 sol
6 str	6 sol
4 str	
2 str	4 str
1 str	2 str
0 str	1 str
00 str	
000 str	0
0000 str	00
3000 Volts	000
8 sol	0000
6 sol	
5000 Volts	5000 Volts
8 sol	8 sol
6 sol	6 sol
TWO-CONDUCTOR	
600 Volts	600 Volts
14 sol	14 sol
12 sol	12 sol
10 sol	10 sol
8 sol	8 sol
	6 sol
6 str	
4 str	4 str
THREE-CONDUCTOR	
600 Volts	600 Volts
14 sol	14 sol
12 sol	12 sol
10 sol	10 sol
8 sol	8 sol
6 str	
4 str	6 str
2 str	4 str
5000 Volts	
2 str	
0 str	

HERE is a low-cost, nonmetallic, rubber-insulated power cable that can be used profitably in many places. It can be buried directly in the earth, in cinder fill, or in swampy ground. It can be installed in ducts or in conduit, on a bridge or in a mine. It even has other uses. Hence, it is the all-purpose "parkway" cable.

Because of its popularity, we have stocked these 51 items—some with Versatol insulation, others with 30-per-cent A.S.T.M.-AO insulation.

If you are in a hurry for cable, it will pay you to order such standards. You then eliminate the bother of specials and get the assurance of prompt delivery—of a high-quality, *proved* product.

Phone or write the nearest G-E office or G-E distributor for current prices and any other details* that you may desire. General Electric, Schenectady, N. Y.

**See Bulletin GEA-3244B, revised February, 1941.*

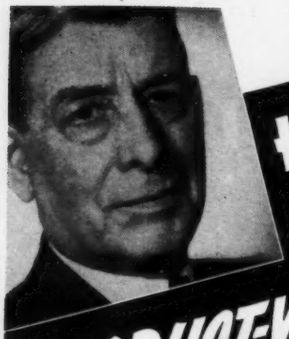
Many other G-E standard cable items can be furnished *right off the shelf*: No. 1799 varnish-cambric braided and leaded, Versatol braided, Flamenol, and tellurium portable.

GENERAL ELECTRIC INSULATED CABLE

ALWAYS THE RIGHT TYPE FOR EACH JOB

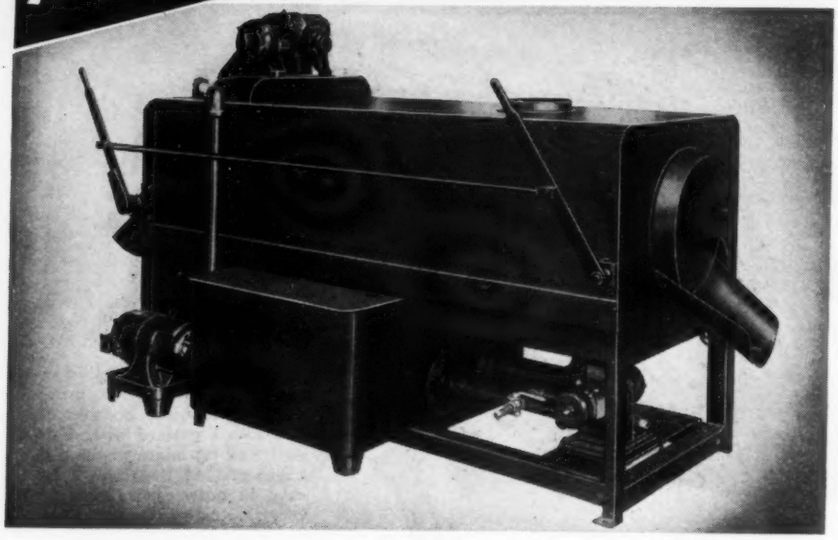
GENERAL ELECTRIC

502-4-1200



HAVE YOU A DIFFICULT PRODUCT-WASHING PROBLEM?

IT MAY BE SOLVED EASIER THAN YOU THINK



YOUR product washing or cleaning problem may be different from that of the Kilian Manufacturing Corporation, Syracuse, N. Y., but we can solve it!

Says FREDERICK KILIAN, General Manager, "The nature of our work is such that after the quenching process both in oil and water, a considerable amount of cyanide adheres to the various parts. This, up to the time we installed your Industrial Washing Machine*, had given us considerable difficulty in bringing out the work absolutely clean and free of foreign matter.

"Now, however, every piece of work passes through this rotary washing machine and comes out *clean* and *dry*, so that there is not the slightest trace of any foreign matter left on the many millions of parts which go through this machine during the course of a month.

"This machine operates continuously 20 hours per day, and its performance has been absolutely satisfactory."

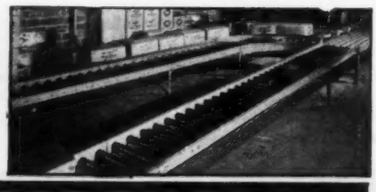
Just as Alvey-Ferguson engineering specialists in product washing machine problems solved this one for Kilian, they can help you solve your product washing problems and products will be washed *cleaner.*

*As pictured above.

AND ALVEY-FERGUSON CONVEYORS CAN HELP YOU *SPEED PRODUCTION* THROUGH *YOUR* PLANT!

Whatever your needs—from a light portable conveyor to a complete "endless stream" conveying system for handling finished products and packages; from raw to waste materials—our 40 years of building *"scientifically-planned"* conveyors for practically every type of industry will be of untold benefit in helping your plant to greater efficiency and lower costs.

Write for new, illustrated catalog of (1) conveyors, (2) industrial washing machines. The Alvey-Ferguson Co., 113 Disney St., Cincinnati, Ohio.



CONVEYING MACHINERY

ALVEY-FERGUSON

INDUSTRIAL WASHING MACHINES AND Conveyors

Carter Products, Incorporated

(*Continued from page* 78)

on a sale margin and the estimating department knocks off some, and then we get the job, or we don't, depending upon whatever it is that puts the Democrats in office and causes shipwrecks. So the estimating department, true to form, knocks some off Art's estimate of this job, and of course we land it.

It's a honey. Chet Wyatt came up to Art's department bright and early one morning to tell him that Burse wanted 5,000 lamps within three weeks. Chet's one of the salesmen.

Art looked up with a puzzled expression. "That so? What do they look like?"

"Look like?" Chet shouted. "For Pete's sake, didn't you have anything to do with the price I gave 'em?"

"Maybe I did, Chet. Keep your shirt on now, son, and we'll go down and see what this is all about."

He looked at the blueprints and looked at his estimates, looked at the figures the estimating department had turned in . . . and must have started thinking about that foremanship job over at Plain Nuts Company, or maybe about retiring to his cabin at the lake.

He got hold of the equipment engineer and gave him the low-down. They worked hard and within a few days had what they prayed was a workable set-up that wouldn't lose the company too much money. The real headache started when they tried to run the job. Everything went wrong. You know how it is on the close ones. . .

Sam Holland, superintendent and son-in-law of the Old Man, called Art in a week or so after the job had been started, and had him a little talk. One of those nice, purring affairs that get under your skin, if you've any left after the first ten minutes.

"Art," says Sam, peering up at him, "did you quote $3.50 on this job?"

Art nodded. All the figures, he saw, were laid out on the desk.

Sam settled back into his chair. "We've got to get these out of here ten days from today, Art, and I'm relying upon you to do it. And we've got to break even, or better, on this order. There's lots of competition would like to have this job of Burse's, and there's no reason why Carter can't do it. Burse is a big outfit. If we make good on this lamp, we'll have an 'in' on a lot of their business—and we need it right now.

"Now, I know there are plenty of reasons why this job is the worst one we've ever had." Sam tapped his fingers on the desk. "What I want is results."

Picking up his 'phone, he told the

HEAT

DEFENSE PLANTS · FACTORIES · WAREHOUSES · STORES

with

JANITROL

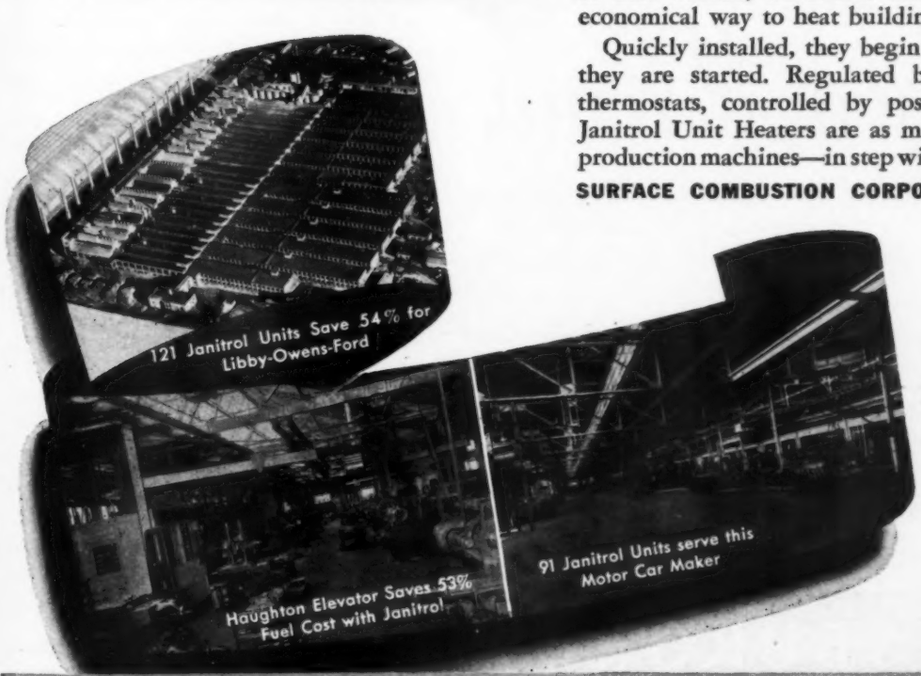
GAS-FIRED UNIT HEATERS

Some of the country's largest factories — and some of the very smallest — have found that Janitrol Gas-Fired Unit Heaters started saving them money even before the heat was turned on, because they saved a large investment in heating plant and fuel storage, and the building space to house them.

Savings came, too, from the flexibility of these self-contained Heating Plants, which deliver just the amount of heat wanted, when and where wanted, the modern, economical way to heat buildings.

Quickly installed, they begin to supply heat instantly they are started. Regulated by individual or group thermostats, controlled by positive automatic devices, Janitrol Unit Heaters are as modern as motorized unit production machines—in step with industry every minute.

SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO


121 Janitrol Units Save 54% for Libby-Owens-Ford
Haughton Elevator Saves 53% Fuel Cost with Janitrol
91 Janitrol Units serve this Motor Car Maker

FOR IMMEDIATE PLANS AND ESTIMATE, WIRE OR WRITE FOR NAME OF NEAREST JANITROL HEATING ENGINEER

WINTER AIR CONDITIONERS
GRAVITY HEATERS
CONVERSION BURNERS
UNIT HEATERS

SC
35 YEARS

SURFACE COMBUSTION

BRUSH SERVICE

AS YOU LIKE IT!

FAST—EFFICIENT—ECONOMICAL

If you want good service on brushes, just contact the nearest Pittsburgh Plate Glass Company warehouse.

"Pittsburgh" maintains warehouses in 81 important industrial centers. There's one near you!

These service warehouses carry complete stocks of Gold Stripe Brushes, for all types of paint jobs, and a full line of Industrial Brushes, such as Floor Sweeps, Mill Dusters, Wire Scratch and Casting Brushes. Orders can usually be filled on a "back-the-same-day" basis.

Write for further information about this service.

PITTSBURGH
PLATE GLASS COMPANY
Brush Division · Baltimore, Md.

operator to get hold of Jim Tyler, the engineer; Al Peasely, my boss in methods and time study; Carl Chase, estimating; Max Carling, production; and Ted Crosier, toolroom. It was going to be a big event.

In another five minutes there were seven of us in the audience, because Al took me along.

"I don't need to tell you why you are here." Sam looked from one end of the group to the other. "From what I hear, this Burse job has you all in stitches."

Then he began. All about this company being "behind the times just because of inability to get jobs like this Burse job out on time, and on the right side of the ledger afterwards." About poor estimating. About designing that could be improved upon. About fixtures that would work. About everything.

All the Brains We Need

"Boys," he wound up, "you've got it in you. In this room are all the brains we need. I've slaved and sweated trying to put this plant up where it belongs. The Old Man and I made a long tour a few weeks ago, visiting customers and prospective customers. Up early in the morning and going late at night. We didn't get enough rest to keep an ant alive. Once in a while we'd get a compliment. But more often we heard that our service was bad, or that someone else could beat us on price.

"We've got to get this Burse job out, and get it out on time, and make a profit on it. It isn't going to be too healthy a place here if we don't. . .

"Art, why did you quote $3.50 on this job?"

Art jumped. He tried to explain that when the estimating was done he had been awfully busy, that he didn't see all there was to it.

Carl Chase next explained in so many words that the reason he had cut down Art's estimate was because he generally did; that he found the foremen usually added enough to be on the safe side.

Jim Tyler explained why it was that tooling was so complicated, and why it wasn't working out too well.

Ted Crosier said that the tools would cost like the devil, made the way Tyler had ordered them.

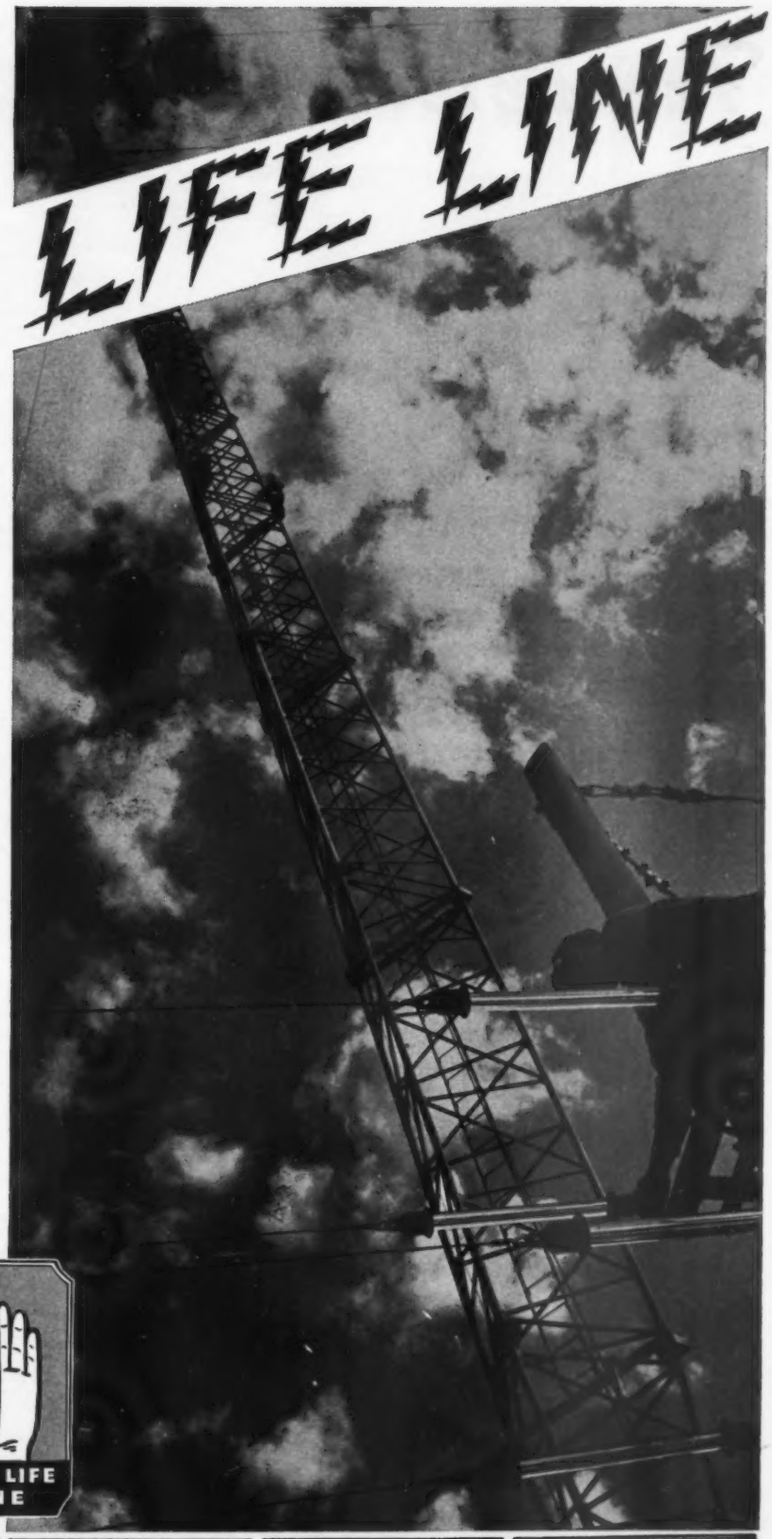
Al Peasely said he'd do the best he could with the standards.

Then the 'bow-wow' broke up.

I took time studies the next couple of days on the job, and after Art had raised the pieces per hour as much as he could, and Al had raised them some more . . . to a point where the operators couldn't possibly make out on the standards set . . . we still lost money on the job, and eventually lost the business because the Burse outfit got burned up with the delay.

I talked to Al Peasely about it later.

Wood's LIFE LINE



Stabbing the ether with globe-girdling impulses, this 718 foot antenna transmits a mighty line of communication—entertainment, music, news! It's a line depended on by hundreds of thousands for keeping up with the world.

In transmission of another kind—power—it's Wood's line of equipment that is depended on for long life, trouble-free service.

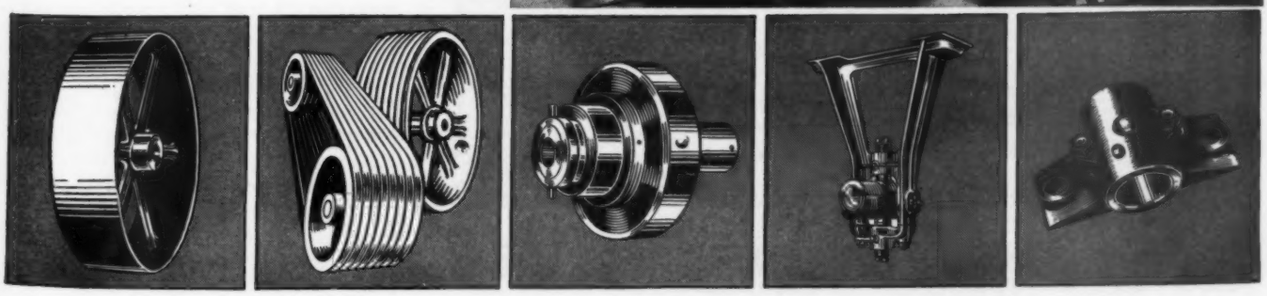
Built on service records from more than 80 years, Wood's Products have become in many plants the standard for judging all such equipment.

By delivering the maximum in economy, efficiency and long service life, Wood's Products will pay their way in your plant. Investigate now . . . it's to your advantage!

T. B. Wood's SONS COMPANY
CHAMBERSBURG, PA.

Everything in Transmission

Bearings — Collars — Clutches — Couplings — Contactors — Hangers — Pillow Blocks — Pulleys — V-Belt Sheaves and Complete Drives



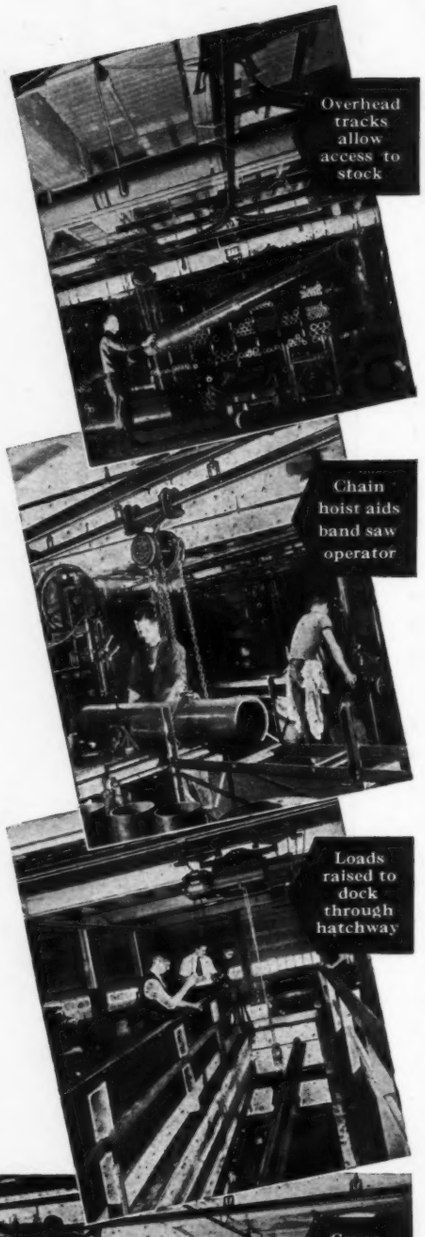
From stock to dock!

When it comes to bottlenecks these days our experience proves that the shipping department is the place that takes a real beating. Pictures here show how stock can move quickly from storage to trucks without congestion.

The extreme flexibility of American MonoRail equipment enables engineers to design such a system, related throughout the plant yet providing constant individual service at each process.

American MonoRail engineers, located in every industrial center, will gladly suggest from their wide experience a solution to your particular problem.

Write for copy of Blue Book illustrating hundreds of overhead monorail installations.



THE AMERICAN MONORAIL COMPANY

13114 ATHENS AVENUE, CLEVELAND, OHIO

Al Peasely is the apple-polishing department head. Smart in keeping one ear to the ground in anticipation of the boss's demands, he never seeks out trouble, and he follows orders to the letter.

"Al, why don't we have an estimating department that really does a job?" I asked one day as I sat beside his desk.

Without turning to face me, Al asked indifferently, "Why? What makes you think we don't have?"

"Because they don't do the job; the foremen do it. And the foremen can't do jobs justice, because they haven't time to pore over blueprints and specifications."

"Why not?" Al turned in his chair and now faced me. "They have to run them; they should know most about them."

"Yes, but to do the job as it should be done," I replied, "it seems to me they'd have to consult the engineer, the toolroom, our department, and estimating."

"Yeah," replied Al, as though I were suggesting rabid radicalism, "and we'd never get all the estimates through."

"It would take more time if the job were done right, perhaps," I argued, "but the job should be done right, if we are going to do it at all. Standards and equipment data can be built up, so that the memory of a busy foreman isn't the only base. The modern way of estimating jobs makes it largely a routine matter. Half the jobs we have in the plant today are 'way off from the original estimates."

"Well, maybe . . ."

"Another thing, Al. A foreman is apt to make estimates that are a protection for himself in case he might have to run the jobs later. And if he gets a job that has been either too loosely or too tightly estimated, he will be prejudiced in favor of time-study standards that are similarly too loose or too tight. After what happened in the Burse case, can't you imagine that Art will be sure to tack on plenty next time?"

"That's the estimator's job, to check on the foreman," asserted Al.

"Which," I said, "is what they cannot do at Carter Products because they haven't sufficient data to do it intelligently.

"Maybe so." Al turned to rummage through some papers on his desk. "Our jobs average out pretty well, anyway. Say, have you got those figures ready on the Inverse Gadget yet?"

That, I knew, was the sign-off. The fact that companies today are finding average costs less and less reliable, makes no difference. If we are low and get a job we've estimated, often as not it is because no one else has made the same mistake. So we get all the money-losers, and are always too high on the jobs we could have made a profit on.

They Say and Do

New York State Agency Aids Subcontracting

By getting started early, the State of New York has been able to provide national defense officials with far more data on tooling and plant capacity than is available in most states. Last year the State Planning Commission at Albany compiled a comprehensive directory of manufacturing and non-manufacturing industries in the state, took inventory of idle plants, and made a census of machine tools. Since then this information has proved its value again and again.

The idle plant inventory includes data on past and potential uses while the machine tool census exhaustively classifies the items by type, use, condition, location, and age. A selective card system is used. Recently these data enabled an important defense prime contractor to locate several special-purpose machines of rare design with a great saving in time and cost.

Employees of the Commission have held meetings throughout the state to introduce prime contractors to smaller manufacturers who collaborate on plans for farming out parts orders in remote areas free from housing and labor shortages. The State Planning Commission, headed by Chairman M. P. Catherwood, is shortly to become a unit of the State's new Commerce Division.

•

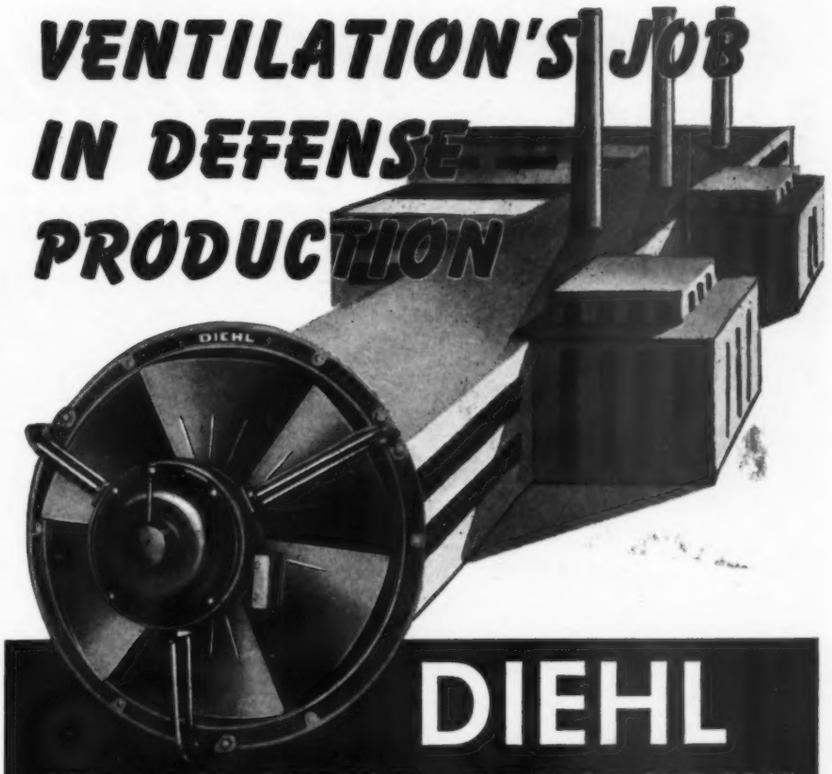
West Coast Expansion on Steel Proposed

Many of the far-reaching changes being wrought by new defense plant construction are difficult to evaluate as yet, but the meaning of one recent proposal, whereby large-scale steel operations would be launched on the West Coast, is immediately apparent.

Henry J. Kaiser, Oakland, Cal., industrial engineer, originated the proposal and took it directly to the White House where he received a hearing from President Roosevelt. On the same day that Kaiser made his bid for $150,000,000 in government funds to finance his proposed plants, the OPM sent W. A. Hauck, steel consultant, westward to check the necessity and practicability of Kaiser's ideas. Kaiser would build:

1. A pig-iron plant at Mount Pleasant, Utah, utilizing ore in that area.
2. A high-grade steel mill in the Bonneville Dam area, making steel

VENTILATION'S JOB IN DEFENSE PRODUCTION



DIEHL
VENTILATING EQUIPMENT

America's defense program calls for full speed production, quality output and improved plant operating efficiency. In all these, VENTILATION plays an important part.

WORKER EFFICIENCY: Proper atmospheric conditions in the plant will increase man-hours by decreasing fatigue and illness. Keeps workers keen, alert, and on the job.

DIEHL VENTILATING EQUIPMENT IMPROVES WORKER'S EFFICIENCY

ECONOMY OF MATERIALS: Good ventilation with improved worker efficiency gives greater accuracy in workmanship—cuts down waste—reducing manufacturing costs.

DIEHL VENTILATING EQUIPMENT REDUCES WASTE

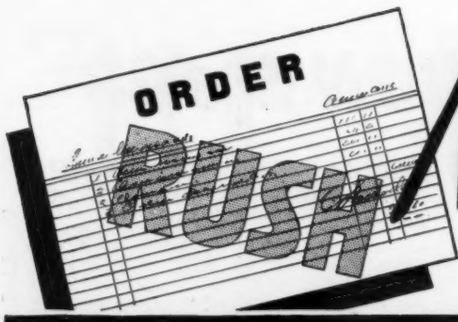
INCREASED PRODUCTION: Proper plant ventilation adds to the efficient use of Man-power . . . Materials . . . Machines . . . steps up production.

DIEHL VENTILATING EQUIPMENT INCREASES PRODUCTION

DIEHL EXHAUST and VENTILATING FANS are products of 52 years of specialized fan manufacturing experience. They are obtainable in a wide range of types and sizes for the efficient, dependable and economical moving of air under various conditions. Literature and prices on request.

Throughout the world, Diehl Ventilating Equipment is held in high regard by satisfied users in every industrial field. Without obligation our engineers will analyze your requirements and submit recommendations of the proper ventilating equipment for maximum results at a minimum in cost.

DIEHL MANUFACTURING CO., Elizabethport, N. J.
Electrical Division of THE SINGER MANUFACTURING CO.
Atlanta Boston Chicago Dallas New York Philadelphia



No Time Now for "Doubtful" Screws

ASSEMBLY DEPT.
Guarantee
OF HIGHEST QUALITY
To assure satisfactory performance, Parker-Kalon Fastening Devices are made to exacting specifications covering dimensional and physical characteristics which are checked at every stage of manufacture, and passed upon by Parker-Kalon's Quality-Control Laboratory. Should this product prove faulty in any way, replacement will be made without charge.
PARKER-KALON CORPORATION
NEW YORK, N. Y., U. S. A.

AVOID SCREWS THAT MAY EAT UP TIME — BOOST COSTS . . . SPECIFY PARKER-KALON QUALITY-CONTROLLED FASTENING DEVICES

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of . . . .*

Hardened Self-tapping Screws
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Now, as never before, it is important to guard against "doubtful" screws. For they can knock assembly schedules haywire! Sure, such screws may *look* all right. Most of them will even *work* all right. But it takes only a small percentage that won't go in quickly, that won't draw up tight, that strip their threads or break, to eat up a whale of a lot of time and increase costs.

So . . . protect yourself against these speed-killing "doubtful" screws! Specify Parker-Kalon Fastening Devices! There's an unequalled GUARANTEE OF QUALITY-CONTROL in every box . . . a GUARANTEE that every Parker-Kalon Screw will go in fast and easily, and hold tight. This GUARANTEE is backed by the industry's greatest Quality-Control Laboratory . . . by Parker-Kalon's unique inspection routine which assures unvarying uniformity of mechanical and metallurgical characteristics.

Be sure of getting Fastening Devices that will "hold up their end" of assembly schedules. Specify PARKER-KALON! Parker-Kalon Corp., 196-200 Varick Street, New York, N. Y.

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Quality-Controlled **PARKER-KALON Fastening Devices**

from scrap and using Bonneville power.

3. Another steel mill in Southern California, using both gas and electricity in a new process to make steel from the Mount Pleasant pig iron.

Kaiser, who has already received a $9,000,000 government loan to build a magnesium reduction plant near San Francisco, is confident he can get into production on steel made from scrap in eight months and on steel made from ore in a year. The plan is held to have post-war significance to West Coast industry, which has had to pay premium prices on Eastern steel.

Of immediate import is the fact that Kaiser expressed open disagreement with President Roosevelt's view that the nation's existing steel facilities are ample to supply defense and civilian needs. Gano Dunn, senior production consultant of OPM, was engaged, during Kaiser's visit, in rounding out an up-to-date revision of his February report on steel capacity upon which the President had based his views.

•

Conscription of Management Proposed, Withdrawn

An intensely significant legislative proposal for the conscription of industrial management executives to serve the government in defense work bobbed up in Congress recently and then, somewhat mysteriously, disappeared.

Sponsor of the idea was Rep. Lyndon Johnson of Texas. He first announced it as an amendment to the bill offered by Representative Vinson of Georgia enforcing a mandatory "cooling off" period in strikes on defense work. Johnson had already sent the text of his amendment to the government printing office when he decided to withdraw it, stating that he would revise it before resubmitting it to the House Military Affairs Committee. Beyond that he gave further explanation.

Because the text was not made public, the details of Johnson's proposal were not known. He told the press, however, that he did not feel that the government was getting the best "managerial brains" available for defense jobs.

"His amendment, he said, would permit the government to compel men to accept certain positions important to the defense program," the Associated Press reported. "Special army and navy boards could survey the available executive material, he said, and select the men desired."

Whether Congress will seriously consider the Johnson plan, if and when it is reintroduced, was doubted by most Washington observers. The idea of "drafting" management is not a new one, however; in fact, it is part of

"DOUBTFUL" SOCKET SCREWS

"BLACKBALLED"!

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16-Point Quality-Control Guarantees
Every Parker-Kalon Socket Screw

Most socket screws are good socket screws. But it takes only a few poor ones in a lot to cause trouble. That's why it pays to specify Parker-Kalon!

For Parker-Kalon gives you complete protection against "doubtful" screws – screws that *look* all right but of which a percentage fail in use – resulting in assembly delays and service complaints. In Parker-Kalon's QUALITY-CONTROL Laboratory – finest in the industry – an exacting 16-point inspection routine assures unvarying uniformity of physical and metallurgical characteristics . . . *eliminates "doubtful" screws.*

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16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

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COLD-FORGED
Socket Screws

High Speed—Low Cost Handling is Simple
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LIFT JACK
EQUIPMENT
Using the Bond Lift Jack-Platform system, materials handling goes on a fast, safe, cost cutting schedule even in the smallest plant. You can start this more efficient method with a minimum of equipment and add to it piece by piece as your plant expands or you modernize more of your handling. Start today to reduce your materials handling cost. The first step is to write for the Bond Lift Jack Bulletin.
BOND FOUNDRY & MACHINE CO., MANHEIM, PA.
There are Bond Truck Casters suitable for every industrial use. Call the Bond distributor in your city or send direct for the Caster Catalog.

ATHLETE'S FOOT

impairs the efficiency of 50% of your employees

U. S. Public Health Service Bulletin (R-674) states that 50% of all adults are afflicted with Athlete's Foot. Shower rooms are primary spreaders of the infection. But also your shower rooms offer your best opportunity to control it, regardless of where your employees contract it.

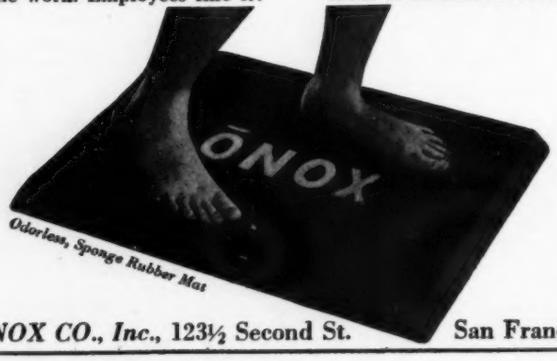
New way to solve problem

Recent research has upset former theories on control of Athlete's Foot. The new procedure is revolutionary—the ONOX method. A safe non-poisonous skin toughener does the work. Employees like it!

You may test it under any conditions you choose to impose and without obligation. For example:

● ***We will ship prepaid, your trial order for any amount of ONOX and equipment. Use it for 60 days. If at the end of that time ONOX has not proved itself to your complete satisfaction (100%) you owe us nothing and return nothing. This offer is open at any time to established industrials.***

We would like to send you the details of the simple ONOX method. Used by hundreds of institutions from coast to coast.



ONOX CO., Inc., 123½ Second St. San Francisco

the Industrial Mobilization Plan which includes a sample bill, already drawn, for the virtual conscription of management men in time of war. Even if Johnson himself does not revive the plan, it is held likely that other Congressmen may introduce it later when it may have more chance of passage.

Johnson's withdrawal of his bill was viewed in some quarters as possibly significant politically. Johnson is President Roosevelt's choice in the three-cornered race for the Senate seat of the late Morris Sheppard. Johnson's continued sponsorship of the "draft management" plan, it was said, might injure his chances in the industrial cities of Texas.

●

Tax Loss to U. S. Seen in Auto Curb

An interesting byproduct of the 20 percent restriction in the production of passenger cars which the automotive industry is soon expected to adopt may be an eventual heavy loss to Uncle Sam.

The companies will of course pay no tax on the sale of war material to the government, which the restriction will increase, whereas the passenger car has been a prolific bearer of tax yields, not only to the federal but to state and local governments and not only at the point of sale but thereafter. A study by the American Petroleum Industries Committee shows that the average family budgets about $150 per year for the upkeep of its automobile and that $50 of this, or more, is paid out in federal, state, and local special automotive taxes.

If eventually, the output restriction results in a lower total of automobiles for the nation, Uncle Sam will feel the difference. In 1940 he collected almost $500,000,000 in taxes on gasoline, oil, autos, trucks, tires, and accessories.

●

Skilled Men Called Back From British Army

As concern grows in Washington over the drafting of skilled industrial workers for selective service, word comes from England of the manner in which a similar problem was solved.

Despite the fact that the British registration law was carefully framed to exempt men whose greater value lay in industrial work behind the lines, many skilled men got into the armed services—mostly as volunteers—before the exemption provision, known as the Schedule of Reserved Occupations, became effective.

Thereupon the Minister of Labour

There is no substitute for experience!

"I didn't know you built cranes that big", a steel man said to us the other day when he saw one of our 250-ton wrecking cranes (pictured below). Yet it is largely because of our more than 50 years experience in building such a variety of cranes — from comparatively small 4 wheel cranes to huge 250-ton wrecking units — that Industrial Brownhoist cranes of every capacity do such an efficient, low cost job of handling. The 1941 Industrial Brownhoist cranes reflect this engineering experience in many ways. The crab mechanism operates more quietly and more efficiently. The cabs on gasoline and Diesel models up to 50 tons allow 360° visibility. Boom construction provides increased strength combined with decreased weight. Power plants develop more power; use less fuel than ever before.

If you are interested in increasing your material handling facilities and at the same time reducing costs, write today for further facts about Industrial Brownhoist Diesel, Gas or Steam locomotive cranes in capacities from 10 to 250 tons.

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set forth to "comb out" from the army, navy, and air force as many skilled men as he could find for return to the armament plants. Within a few months he had recovered 30,000 trained workers in this fashion. Proportionately, this would be the equivalent of 120,000 workers in the U.S., a worth-while number. However, the armed forces released these men provisionally—with the understanding that, as the mechanized army expands, they may be called back into the service.

This procedure is described in a study entitled, "The Labour Situation in Great Britain," conducted by the International Labour Office and distributed in this country by the ILO's Washington office. It is significant in view of recent statements by army and OPM officials who are frankly worried because many local draft boards are denying deferment to skilled men dispite instructions to the contrary from Brig. Gen. Lewis B. Hershey of the Selective Service Administration. Such preferment denials have been noticed especially in Michigan and New Jersey, defense officials said. These two states are among the foremost in defense industrial production.

•

Dollar Value of Domestic Truck Bookings Reaches New High

While March domestic bookings of electric industrial trucks and tractors in units were somewhat lower than the record peak reached during February, the dollar value reached a new high, as revealed by figures released by the Industrial Truck Statistical Association, 208 South LaSalle St., Chicago. During March a total of 436 units were booked, as compared with 112 in the same month of 1940, and 478 in the preceding month.

Total net value of chasses only was $1,557,591.91 as compared with $376,439 in March of 1940, an increase of 313 percent and $1,441,521.50 in February, an increase of 8 percent.

Forty-five non-elevating platform trucks with capacities and base chasses prices ranging from 2,000 to 10,000 pounds and $1,200 to $3,965 respectively, had a total net value of $89,030. All net values are at factories, after additions and deductions for variations from standard specifications, trade-in allowances, etc., when applicable. There were 318 cantilever trucks, with capacities and base prices ranging from 1,200 to 25,000 pounds and $1,200 to $13,865 respectively, with a total net value of $1,223,967; 60 crane trucks, capacities and base chasses prices ranging from 3,000 pounds at 7 feet to 6,000 pounds at 6 feet radius and $4,250 to $5,475 respectively, had a total net value of $228,976; 10 light- and heavy-duty

means EXTRA GOOD for you!

NEW flameproof DELTABESTON

meets critical wiring needs

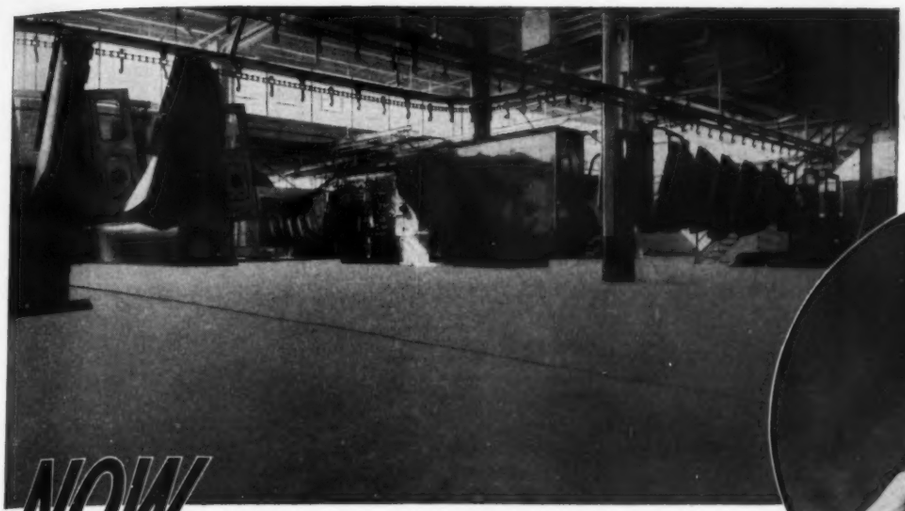
Whether or not you're actually engaged in wiring aircraft, you'll be interested in the new General Electric FLAMEPROOF Deltabeston wire, now available from GRAYBAR in gages from 22 to 2/0. » » » The insulation of this stranded copper wire is so designed that even if a conductor should become incandescent, the insulation will adhere to the conductor. Fire will not be carried to adjacent conductors. This has been accomplished while at the same time reducing weights and diameters of the new wire even below those now called for in existing aircraft wire specifications.

Insulation is comprised of (1) Color coded separator to permit easy stripping; (2) Synthetic Flameproof Insulation (high dielectric, moistureproof and acid resistant); (3) Impregnated felted asbestos (an abrasion resistant fireproof wall); (4) Colored flameproof braid.

Consider the place of this wire, not only in aircraft, but in wiring instruments and other equipment where the fire hazard or other factors call for maximum protection in minimum space. Or write direct for bulletin to Graybar Electric Company, Graybar Building, New York.

GRAYBAR QUALITY *Everything Electrical* GRAYBAR ELECTRIC COMPANY

GRAYBAR IN OVER 80 PRINCIPAL CITIES



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For Concrete or Wood Floors—Inside and Out

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IT RESISTS FUMES and CHEMICALS
6 Attractive Colors

Here's a genuinely super floor paint—a rubber-base floor paint—achieved through the miracle of chemistry and thirty years of research. It damp-proofs. It beautifies. It has all of rubber's resistance to wear, moisture and chemicals. Like rubber, it is easy to keep clean—and it far outlasts, outwears ordinary paint. It answers the floor paint problem for all types of industrial and public buildings. It's exactly the thing for basement floors, outdoor porches or garage floors where ordinary paint does not hold. And as an aid to cleanliness and sanitation, PARATEX stands all by itself. You need PARATEX.

Also TRUSCON *PARATEX* Metal Coating

The same qualities which make PARATEX rubber-base floor paint invaluable for cement or wood floors, inside or out, are also outstanding in PARATEX Metal Coating. Whatever the metal paint requirement, PARATEX Metal Coating provides many fundamental advantages. It is ideal for structural steel, steel sash, tanks, and all types of metal or steel surfaces, inside or out. PARATEX Metal Coating is easy flowing, easy brushing and quick drying and, just as important, it is truly economical.

Write for Information on Truscon PARATEX for Floors and Truscon PARATEX Metal Coating

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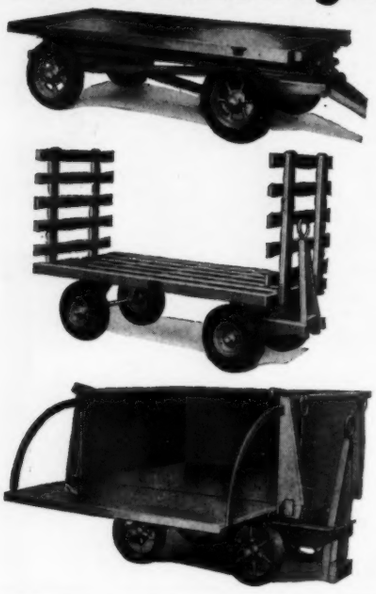

Today, one type of EWC Trailer is hauling hay to a stock yard, while another type is handling clay in the yards of a tile factory.

No matter what materials you handle, EWC Engineers can help reduce your handling costs and increase your handling efficiency!

The complete EWC Trailer Line—with its innumerable variations—provides the proper hauling equipment for floor, yard, inter-plant, or street; in any capacity desired and with any type of body.

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SAVED! 45-Minutes Drying Time!

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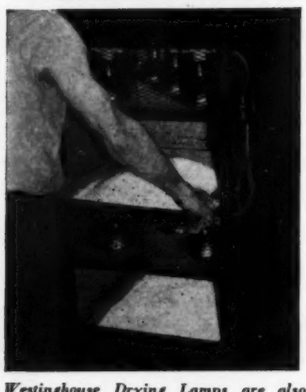
HOW MUCH TIME COULD YOU BE SAVING?



Westinghouse Drying Lamps are also being used to dry paints, lacquers and enamels faster and better.

One Case Out of Thousands!

Whatever type of heating or drying problem you have in *your* plant, chances are Westinghouse Radiant Heat Drying Lamps can save time and money for *you*, too. Case illustrated shows ten R40 drying lamps removing moisture from granulated cellulose acetate prior to loading in press. Drying requires *15-minutes*, replacing a steam dryer requiring *one hour*.

Faster! Cheaper! Easier!

It's easy to see why these lamps do a faster, better, more economical job: the infra-red rays penetrate *deep down*, starting the drying or heating process from the inside *instantly*, *uniformly*, *efficiently*. Easy to use as light bulbs; no costly insulated ovens or pre-heating required. See your local Westinghouse Mazda Lamp distributor or write for folder, Westinghouse Lamp Division, Bloomfield, N. J.

Westinghouse

RADIANT HEAT DRYING LAMPS

tractors with base prices ranging from $1,395 to $2,275 had a total net value of $16,728.91; 3 special trucks, capacities and base chasses prices ranging from 2,000 to 3,500 pounds and 79 cubic feet and $1,770 to $5,750 respectively, had a total net value of $11,995.

The March figures as shown are after adjustments for cancellations of one 4,000-pound capacity fork truck with a total net value of $4,825, and one 6,000-pound capacity High Lift Truck with a total net value of $3,725 booked in February and January respectively.

•

Hobart Brothers Opens Arc Welding School

In a handsome new building of modernistic design, the Hobart Trade School Inc. has begun the training of students in arc welding with a capacity registration of 80. The school is a non-profit organization sponsored by Hobart Brothers Inc., of Troy, Ohio, and is situated close to the Hobart plant. Its aim is to send qualified welders into the field.

The building, built entirely of arc welded steel and glass, contains 50 individual welding booths with complete welding equipment and separately regulated ventilation. The main study course includes 160 hours of thorough training in the metallic arc welding of steel with both plain and coated electrodes. Advanced courses for experienced steel welders are provided in welding non-ferrous metals or special alloys.

In the principal steel welding course, instruction lasts an average of four weeks but is personalized so that apt pupils may progress ahead of slow learners. All pupils are permitted to attend lectures and classes given at the plant for Hobart personnel and may observe skilled men at the work of joining metals used in the manufacture of arc welding machines, motor generators, and other products.

Eventually the school will provide complete training in machine shop practice. A recent sample poll of former students showed that practically every Hobart student finds employment in welding and that there is always a waiting list ahead for especially apt students.

•

Who Causes Strikes? Employers, Says CIO

"Anti-union bosses" are "responsible for all the current employer trouble," in the opinion of CIO columnist and publicity man Len De Caux.

Those few quoted words exemplify briefly the slant that most CIO edi-

Southern ILLINOIS Offers Industry

In Southern Illinois, opportunities for Industry range from canning and processing the apple and peach crops of this section, to the manufacture of articles in which the mineral deposits of the region are utilized.

A profitable and logical field for canneries is offered by the availability of markets, labor and other production advantages in close proximity to the peach and apple regions of this section of the State.

Southern Illinois is rich in mineral resources. More than half the coal production of the State is mined in the southern counties. The entire output of fluorspar (more than 40% of the national production) and of fullers earth, is mined in Southern Illinois. Oil production of Illinois centers in this section. Limestone, sand, gravel, shale, and clay deposits are spread over the southern part of the State. The abundant natural water supplies have been made more readily available to Industry by construction of artificial lakes for storage reservoirs. The combination of natural resources available in Southern Illinois presents an opportunity for profitable operations by manufacturers requiring large supplies of minerals, water and low cost fuel.

Special Confidential Report to Executives

Write the Illinois Development Council today for a special detailed report on all the advantages Southern Illinois offers Industry—a report giving full details on labor, transportation, power, fuel and other production and distribution factors. Please describe the nature of your business and list your requirements in order that a truly practical and informative report may be submitted for your consideration. Your inquiry will, of course, be kept strictly confidential. Write—

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ILLINOIS

THE STATE OF BALANCED ADVANTAGES

The availability of desirable plants is an added advantage offered industry by Southern Illinois.

Factory buildings suitable for light, medium and heavy manufacturing are ready to occupy.

All production and distribution facilities are available in cities in which plants are located.

MORE Production from Every Man, Machine and Work Space . . .

with

LAMSON

CONVEYORS

Now is the time—when work pressure is mounting steadily—to re-examine your planning and routing methods. Question every sequence of operations, every manual handling job to increase the production of men, machines and work space:

- Has any process or layout outlived its usefulness?
- Is there any unnecessary movement of men or materials?
- Can any operaton be eliminated . . . simplified . . . or combined with another?
- Is unfinished work piling up at any point, robbing you of capital and floor space?
- Is any workman waiting for the materials needed for his next job?

Just use this check-list as a reminder and make a critical inspection tour of your factory. Keep in mind at every turn the staggering cumulative waste of needless handling, backtracking, fatigue. Then ask the nearest Lamson field engineer to confer with your planning, plant-operating and time-study men.

Get the full benefit of Lamson's 61 years of materials-handling experience, plus Lamson's line of modern conveying equipment. Cooperation between Lamson engineers and factory executives—the combination of general experience and specific knowledge—has worked out more efficient, more economical systems for countless industries.

● *Don't wait. Make a practical start today. Just sign and mail the coupon for information on the application of Lamson conveyors to your industry.*

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Without cost or obligation, please send me by return mail information regarding the application of Lamson Conveyors to my business.

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Company.....

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torial material is now taking. Strikes are frequently called not "labor trouble" but "employer trouble," and the belief that strikes are caused not by unions but by employers is seldom left to inference but is stated as fact.

Later on in the same essay, De Caux proposes that employers, "before they refuse to negotiate wage increases, might be required to cool off by counting not just from 1 to 100 but all the way from 1 to the millions or tens of millions of profits they are making.

Some sample headlines from a recent issue of the CIO news: "Southern Mine Owners Stall, Delay Coal Pact," "G.M. Policy May Force Walkout," and "Employers Cause Strikes, Says League." The last refers to a publication of Labor's Non-Partisan League (A CIO offshoot) which holds that "employers are responsible for more than 95 percent of the strikes and other delays in production."

AFL publicity takes a more moderate tone. Its columnist, Philip Pearl, opposes "cooling off" legislation and praises the National Defense Mediation Board, but refrains from attacks on management. Instead he lambastes communists in the CIO. One AFL headline predicts victory for the Federation in the coming NLRB vote at the Ford Motor Company and refers to the recent Ford walkout as a "CIO minority strike."

●

Cost-of-Living Pay Seen in Comeback

Will the speed-up in industrial activity bring a revival of wage plans involving a sliding scale of increases (and decreases) in tune to changing living costs? There is nothing new about the cost-of-living bonus, but there are signs that, after languishing during the depression years, it may be taking a new lease on life.

Details vary, but the average plan follows a standard outline. First a base rate is chosen, often the current rate. The amount of the bonus is decided, usually corresponding to changes in the cost-of-living indexes prepared either by the Bureau of Labor Statistics (Labor Department) or the National Industrial Conference Board. If the index rises 3 percent in a given period, wages are increased 3 percent.

Frequently wage increases are granted just before adoption of the plan and the increased pay scale is made the base rate. This helps to "sell" the program to organized labor which, generally, has had misgivings. Union leaders have opposed the sliding scale because it prevents employees from sharing in the exceptional profits which a company may sometimes enjoy and because it commits

. . . cutting assembly cost

to help **sell** *it*

For quick precision assembly, simply *peel* .002 or .003 inch precision gage laminations from the solid Laminum shim. Provide easy, accurate adjustment . . . to fitted mechanical parts such as bearing assemblies, sliding fits, gear clusters and the like. Help meet *your* competition through lower assembly costs. ● *Shims cut to your order. Stock shim materials obtainable from mill supply distributors.*

Laminated Shim Co., Inc.
54 Union St., Glenbrook, Conn.

Write for file-folder of shim application photos—with Laminum sample.

LAMINUM
TRADE MARK

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

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Where EXPLOSIONS *are a Hazard..*

THE ONLY

Approved

MECHANICAL WATER COOLERS

ARE **WESTINGHOUSE**

A basically different and exclusive feature in the Westinghouse design makes possible the only water coolers approved by Underwriters' Laboratories, Inc., for Class 1, Group D locations... places where explosions are a hazard.

UP TO 21 GALLONS COOLED IN ONE HOUR FOR ONLY 1¼ CENTS

This figure applies to heavy-duty models and is based on cooling water for bubbler service from 80° to 50° at a 3-cent electric rate. For cup service these models will cool approximately 453 four-ounce drinks for one cent. A complete line of other models is available for every requirement.

THEY HAVE WHAT IT TAKES FOR "ALL OUT" DEFENSE WORK

Under grueling conditions of extreme heat and constant use, Westinghouse coolers have proved outstanding dependability. Where defense schedules mean "three shift" service, Westinghouse coolers can "take it"... and deliver continuing satisfaction. They are powered by the HEART OF A CHAMPION... the famous Westinghouse Hermetically-sealed Refrigerating Unit.

EXCLUSIVE FEATURES THAT MEAN MORE FOR YOUR MONEY

Non-Clog Drain • Stainless Steel Top • Special Capacity Booster • High Efficiency Cooling Chamber • Built-in Watchman. • The famous Westinghouse Hermetically-sealed Unit is backed by a 5-year Replacement Warranty.

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Phone your Westinghouse distributor for complete information or—

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WATER COOLERS

HERMETICALLY-SEALED FOR *EXTRA* YEARS OF TROUBLE-FREE PERFORMANCE

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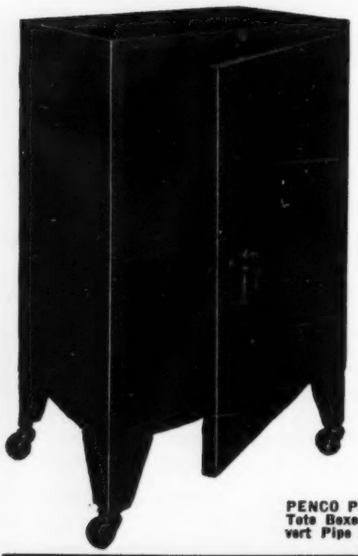

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•

BOOKS

THE MANAGERIAL REVOLUTION

James Burnham. The John Day Co., Two West 45th St., New York. 285 pages. $2.50.

The author's object—he believes the capitalistic order is on the way out—is not to put over a program of social reform, but rather to "elaborate a descriptive theory (the managerial revolution whereby the managers and those who wish to be managers will head the new order) able to explain the character of the present period of social transition and to predict, at least in general, its outcome." He does not concern himself with the question as to whether the facts indicated by this theory are good, just, or desirable. His interest really lies in the truth or falsity of the theory, as judged on the basis of the evidence now at our disposal.

THE FIELDS OF PERSONNEL WORK

John G. Darley, Assistant Professor of Psychology and Director, University of Minnesota Testing Bureau; and Ralph F. Berdie, Administrative Fellow, University of Minnesota Testing Bureau. Science Research Associates, 1700 Prairie Ave., Chicago. 48 pages, illustrations, cartoons, bibliography. 50c.

A brief introduction to personnel work, discussing training requirements, duties, earnings and promotion routes. Of special value to young men interested in personnal work and management as a profession. The first chapter defines personnel work. Chapters II, III, and IV show the personnel worker's place in schools, industry, and government. Qualifications, training, job opportunities, and salaries are discussed in the fifth and sixth chapters.

ECONOMIC FACTORS AFFECTING INDUSTRIAL RELATIONS POLICY IN NATIONAL DEFENSE

Sumner H. Slichter, Lamont University Professor, Harvard University. Industrial Relations Counselors, Inc., Rockefeller Center, New York. 112 pages, tables. $1.50.

This second monograph on the subject, the first appeared late in 1939, is based on recent economic data and developments as related to our war economy. It sets forth the factors management will want to consider when formulating policies to meet present conditions. Among the topics covered are: Size and cost of the defense program, labor requirements, timing of the program and the peak demand, cost of living, labor shortages, wage policy, labor organization, strikes, modifications needed in trade agreements, union-management cooperation.

HANDBOOK OF WELDED STEEL TUBING

Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland. 86 pages, tables, diagrams, illustrations, index. Ring binder. $1.

A guide to engineers and laymen engaged in the application of welded steel tubing, this book contains information on the physical, chemical, and metallurgical properties of welded carbon and alloy steel tubing together with commercial tolerance

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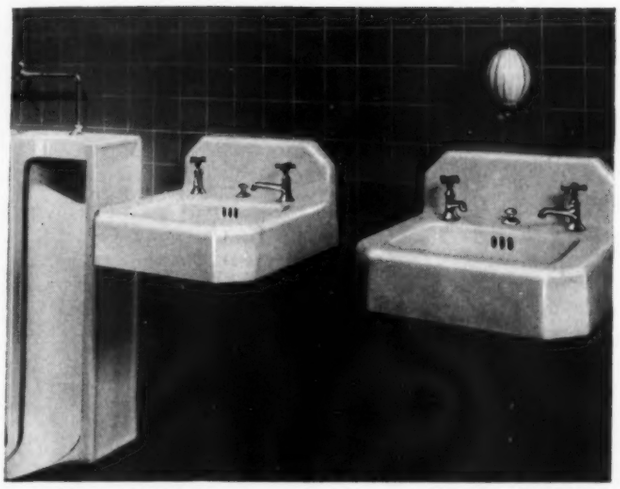

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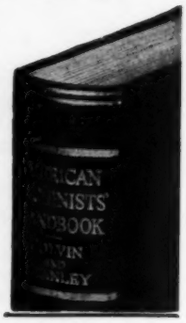

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limitations and extensive engineering data. The author has designated as welded tubing that which is so manufactured as to have a solid wall throughout. For the design engineer, the properties of welded steel tubing are summarized and engineering and fabricating data thought to be most essential to its correct use are included.

INDUSTRIAL RECREATION

Leonard J. Diehl, Fellow, Purdue Research Foundation, Fellowship Number III; and Floyd R. Eastwood, Ph.D., Associate Professor of Physical Education, Purdue University, Lafayette, Ind. 75 pages, tables, bibliography, appendix. 50c.

A comprehensive study of industrial recreation, including history, development, and present status. Chapter headings include Administration, Programs, Facilities and Equipment, Values of Recreational Activities. Data based on questionnaires and personal visits to plants are shown in table form. A valuable guide book to any company interested in starting or extending a recreational plan for employees.

THE HUMAN ELEMENT IN PERSONNEL MANAGEMENT

Lawrence A. Appley, Educational Director, Socony Vacuum Oil Co. Society for Personnel Administration, P. O. Box 266, Washington, D. C. 34 pages. 35c.

"Proper dealing with the human factor in an organization is management's task, . . . and cannot be delegated to staff members or departments," says the author in this discussion of the responsibilities of the administrator to his employees. He points out why he believes the present era will make of personnel administration and management responsibility one and the same thing. The basic principles of organization and management are discussed and a management formula is fully set forth.

FIRE DEFENSE

Edited by Horatio Bond, Chief Engineer, N.F.P.A. National Fire Protection Association, 60 Batterymarch St., Boston. 221 pages, illustrations, index. $1.50.

Because fire safety in industrial properties is of prime importance in defense production, extensive material on air-set fires, bombs, sabotage, activities involved in civilian defense, fire fighting, safeguarding of industrial production for defense has been compiled and copiously illustrated. Object is to acquaint you with the problem of fire in wartime so that you will not be caught unawares should bombs drop and fires blaze about you. That the best fire defense is a strong offense is the theory underlying the book.

TRADE-NAMES INDEX

Special Libraries Association, 31 East 10th St., New York. 179 pages. $4.

Object is to aid in the identification and definition of numerous products known and sold under trade names, brand names, trade marks. Listing of 3,496 such names defines each and in most cases gives a reference to a printed source of further information. It is concerned primarily with materials, processes, and equipment having some technical significance. Bibliography of sources of trade names and trade marks includes a record of more than 100 other lists or sources of further information.

HANDBOOK OF INDUSTRIAL FABRICS

George B. Haven, in Charge of Textile Research, Massachusetts Institute of Technology, Emeritus. Wellington Sears Co., Inc., 65 Worth St., New York. 789 pages, tables, charts, illustrations, index. $2.

Third edition. Handbook for textile engineers and their staffs, buying and selling organizations, and students contains extensive information on the physical properties of fabrics. In the preparation of this edition the text and illustrations have been brought up-to-date as regards design, form, and principle: Chapter I covers the marketing of cotton in the United States and contains statistics regarding acreage yield and production: Chapter II includes stroboscopic photographs showing principles of ring spinning; Chapter IV has new illustrations of a number of textile testing machines; Chapter VIII includes the new

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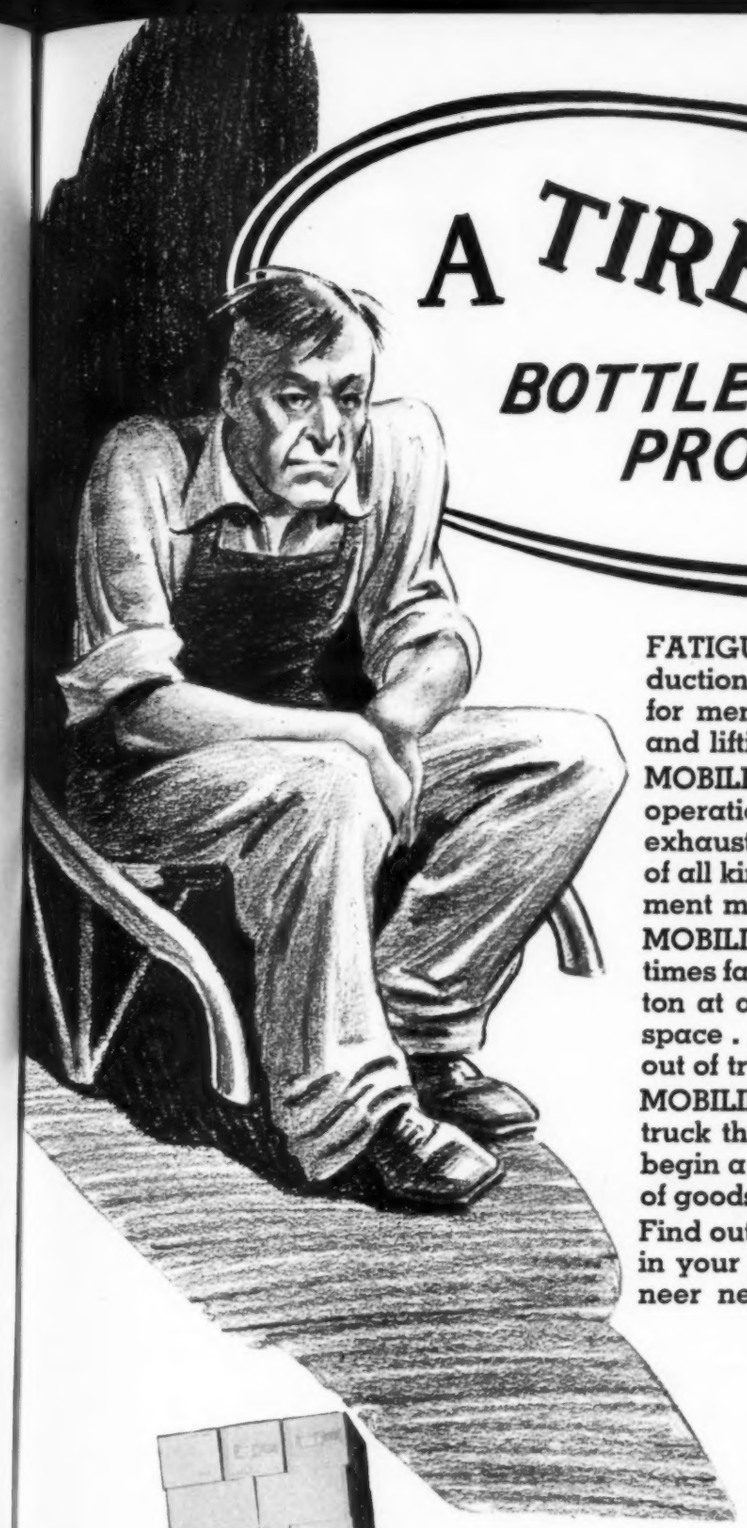

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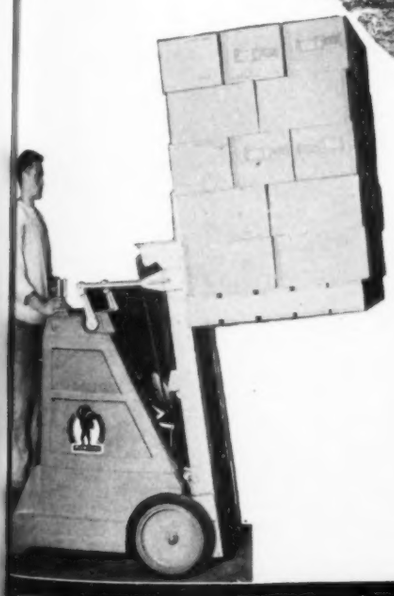

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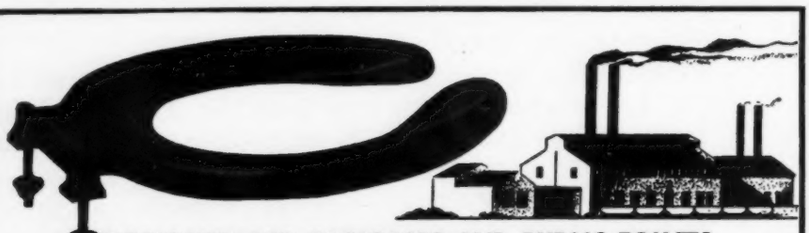

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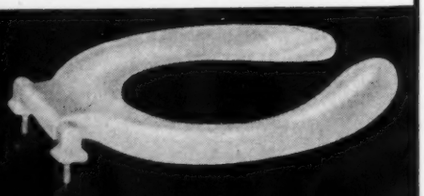

STANDARD TANK & SEAT CO. CAMDEN, N. J.

A.S.T.M. specifications of textiles as approved during 1940. Bibliography of selected government publications on textiles finishes up the book.

PROBLEMS AND POLICIES IN INDUSTRIAL RELATIONS IN A WAR ECONOMY

Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J. 14 pages. 10c.

Second supplement, dated March 1, 1941. First supplement was published November 15, 1941. A list of selected references from various sources pertaining to industrial relations. Both American and British sources are given.

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ON THE CALENDAR

MAY

5–7, American Gear Manufacturers Association, Annual Meeting, Hot Springs, Va. J. C. McQuiston, Secretary, 802 Shields Building, Wilkinsburg, Pa.

6, American Leather Belting Association, Semi-Annual Meeting, Chicago. E. R. Roth, Executive Manager, 53 Park Row, New York.

8–9, National Metal Trades Association, Annual Meeting, Chicago. Harry S. Flynn, Secretary, 60 East 42d St., Room 710, New York.

11–15, National Electrical Manufacturers Association, Hot Springs, Va. R. J. Blais, Convention Manager, 155 East 44th St., New York.

12–17, National Fire Protection Association, Annual Meeting, Toronto, Canada. Robert S. Moulton, Technical Secretary, 60 Batterymarch St., Boston.

15, Association of Consulting Management Engineers, Semi-Annual Meeting, New York. Nathaniel W. Barnes, Executive-Secretary, 347 Madison Ave., New York.

15–16, Industrial Personnel Conference, Purdue University, Lafayette, Ind. Professor D. L. Arm, Acting Director, Personnel Department, Purdue University, Lafayette, Ind.

19, American Welding Society, Los Angeles. Miss M. M. Kelly, Secretary, 33 West 39th St., New York.

19–21, American Institute of Chemical Engineers, Semi-Annual Meeting, Chicago. Stephen R. Tyler, Secretary, 50 East 41st St., New York.

19–23, American Society for Metals, Los Angeles. W. H. Eisenman, Secretary, 7301 Euclid Ave., Cleveland.

22, American Iron and Steel Institute, Annual Meeting, New York. Walter S. Tower, Executive-Secretary, 350 Fifth Ave., New York.

22–23, Society for the Advancement of Management, Semi-Annual Meeting, Washington, D. C. Miss E. Buckley, Executive-Secretary, 29 West 39th St., New York.

26–29, National Association of Purchasing Agents, Annual Meeting, Chicago. G. A. Renard, Secretary, 11 Park Place, New York.

JUNE

16–19, American Society of Heating and Ventilating Engineers, San Francisco. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

16–20, American Society of Mechanical Engineers, Semi-Annual Meeting, Kansas City, Mo. Ernest Hartford, 29 West 39th St., New York.

16–20, American Institute of Electrical Engineers, Summer Convention, Toronto, Canada. H. H. Henline, Secretary, 33 West 39th St., New York.

23–27, American Society for Testing Materials, 44th Annual Meeting and Exhibit of Testing Apparatus and Related Equipment, Chicago. B. E. Hess, Assistant Secretary, 260 South Broad St., Philadelphia.

30–July 3, Conference on Mechanical Engineering Instruction, cooperative project of S.P.E.E. and A.S.M.E., Purdue University, Lafayette, Ind. Professor E. S. Ault, School of Mechanical Engineering, Purdue University, Lafayette, Ind.

UNIVERSITY SUMMER COURSES FOR EXECUTIVES AND ENGINEERS

June 9–27, Summer Management Course devoted to Production Planning, Motion and Time Study, and Related Subjects, University of Iowa. Ralph M. Barnes, College of Engineering, University of Iowa, Iowa City.